National Park Service
Channel Islands National Park

Technical Report CHIS-97-01

KELP FOREST MONITORING
1995 Annual Report

by:

DAVID J. KUSHNER
DEREK LERMA
JEFF MONDRAGON
and
JENNIFER MORGAN

CHANNEL ISLANDS NATIONAL PARK
1901 SPINNAKER DRIVE
VENTURA, CA 93001

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

The 1995 results of Channel Islands National Park Kelp Forest Monitoring Project are described in this report. Population dynamics of 68 taxa or categories of algae, fish and invertebrates were measured at 16 permanent sites around the five islands within the Park. Survey techniques utilized SCUBA and surface-supplied-air, and included quadrats, band transects, random point contacts, fish transects, video transects, size frequency measurements, artificial recruitment modules, and species list surveys. Temperature data was collected using remote temperature loggers. Size frequency measurements were taken from artificial recruitment modules at ten sites. In 1995, eight sites had *Macrocystis pyrifera* (giant kelp) forests, one site had moderate abundance's of red algae and *Strongylocentrotus franciscanus* (red sea urchins), and seven sites were dominated by echinoderms. Of these seven sites, one was dominated by *Pachythyone rubra* (the aggregated red sea cucumber), one by *S. franciscanus*, four sites by *Strongylocentrotus purpuratus* (purple sea urchins), and one by both *S. purpuratus* and *Ophiothrix spiculata* (brittle stars). Wasting disease was not observed in sea stars. Wasting syndrome was observed in sea urchins.

FOREWORD

1995 was an important year for database management in the Kelp Forest Monitoring Program. After the start of the 1995 field season we began a painstaking process of converting our databases from DbaseIII to Microsoft Access7.1. The purpose of the change was to convert all of the Inventory and Monitoring (I&M) data at Channel Islands National Park to a relational database program such as Access for integration of all the I&M programs at the park.

Since the first data were collected by the Kelp Forest Monitoring program, data management at the park has undergone 10 major changes in software and hardware. From the Apple IIe and DBMaster software that took hours to calculate simple means for a station, to today's Pentium computers and relational database capabilities of Access, we've come a long way. The integrated capabilities of MS Office make data storage, manipulation, and reporting much easier than ever before. Automation of the report tables will speed the preparation of annual reports and free us to work on trends and other analyses.

All of our files (from species lists to size frequencies to counts) are now related and can be easily queried. Especially exciting is the ability to relate different programs, for instance weather or oceanographic data with the kelp forest. Although switching the Dbase files over to Access was relatively straight forward, new nomenclature, data entry and reporting procedures needed to be created. This caused some delay in preparing this annual report, but will result in smoother preparation in the future. The new data entry procedures along with changes resulting from the formal review of the monitoring program (Davis et al., 1996) are being carefully documented in a new edition of the Kelp Forest Monitoring Handbook (in preparation).

For the purpose of this report and subsequent reports, changes in nomenclature include the removal of site numbers and small changes in the site name acronyms. The order of which we describe the sites and present the data summaries will remain the same. That is, the sites are presented from North/West to South/East. The most significant change to the annual reports is a result of report automation. In order to automate data reduction into means and size frequency tables it was necessary to separate out each sampling/data type. Volume II of this report contains ten appendices, one for each sampling/data type. We have also separated this report into two volumes. Volume I, contains the text, and Volume II contains the ten appendices of the summarized data. We believe that most people requesting this report are interested in the text and not the seemingly endless list of data summaries. By creating two volumes we hope to save valuable resources and printing cost by sending only the volumes needed by the report users.

EXECUTIVE SUMMARY

Channel Islands National Park has conducted long-term ecological monitoring of the kelp forests around Santa Barbara, Anacapa, Santa Cruz, Santa Rosa, and San Miguel Islands since 1982. Permanent transects were established at 16 sites between 1981 and 1986. In 1995, the sites were monitored during seven five-day cruises between June and September. The 1995 kelp forest monitoring was completed by 34 National Park Service (NPS) and volunteer divers completing a total of 754 dives.

Divers using SCUBA or surface-supply-air completed all quadrats, band transects, random point contacts, size frequencies, artificial recruitment modules (ARMs) and video transects. All fish transects, except for one at Rodes Reef, Santa Rosa Island were completed. This fish transect was not completed due to unsafe diving conditions. Transect lead line repair was completed as necessary at all locations, but several locations are in need of new eye bolts to hold the lead line in place. ARMs were repaired as needed at several of the sites, however several ARMs were missing and not replaced due to limited supplies and time. Temperature loggers were retrieved and successfully downloaded at all sites except Yellowbanks on Santa Cruz Island where the logger was missing. A new temperature logger was deployed at this site.

In 1995, *Macrocystis pyrifera* (giant kelp) forests were present at eight of the 16 sites. These sites included Cat Canyon at Santa Barbara Island, Cathedral Cove and Landing Cove at Anacapa Island, Gull Island South and Yellowbanks at Santa Cruz Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, and Wyckoff Ledge at San Miguel Island. Seven of the sites were dominated by echinoderms. Arch Point and Southeast Sea Lion Rookery, Santa Barbara Island, and Pelican Bay and Scorpion Anchorage, Santa Cruz Island were dominated by *Strongylocentrotus purpuratus* (purple sea urchins). Hare Rock, San Miguel Island was dominated by *Strongylocentrotus franciscanus* (red sea urchins). Admiral's Reef, Anacapa Island was dominated by both *S. purpuratus* and *Ophiothrix spiculata* (brittle stars), however some *M. pyrifera* was present along the west end of the transect. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra* (aggregating red sea cucumbers). Rodes Reef, Santa Rosa Island was an open area with a moderate abundance of red algae and *S. franciscanus*.

The most significant changes since 1994 occurred at Admiral's Reef, Anacapa Island, Arch Point and Southeast Sea Lion, Santa Barbara Island, and Pelican Bay, Santa Cruz Island. All of these sites experienced a radical decline in algal abundance and reciprocal increase in sea urchin densities. Three of the four sites experienced the highest density *of S. purpuratus* (purple sea urchins) ever recorded at the sites. The other site, Arch Point, had *S. purpuratus* densities of 134/m2. This site only had a greater density in 1986 of 154/m2. The changes at Pelican Bay, Arch Point, and Southeast Sea Lion were

especially disappointing because algal cover had recently reestablished itself and these sites appeared to be returning to kelp forests.

The change at Admiral's Reef came as a particular surprise since this site has historically been relatively stable with high diversity. In addition to the increase in *S. purpuratus* (purple sea urchins), this site increased in brittle star, *Ophiothrix spiculata*, densities. In 1994, this site was described as a "Mature kelp forest with a moderate understory of brown algae and a diverse assemblage of fish and invertebrates" (Kushner et. al., 1995). This year the site is described as a *S. purpuratus* and *O. spiculata* barren, with a sparse kelp forest on the west end of the transect. Fish were notably less abundant and diverse this year. From our observations and other reports it appears that *O. spiculata* is increasing in densities in many areas around Anacapa and Santa Barbara Islands. There is little information that exists about this species.

Aside from the two Santa Barbara Island sites mentioned above, sea urchin densities around the Cat Canyon site are also increasing. Patches of sea urchin barrens were common close to the transect. Overall, these three sites appear to be a good representation of the overall situation on Santa Barbara Island. This summer there was very little *Macrocystis pyrifera* canopy cover around the Island compared to 1994, and high densities of sea urchins were reported from elsewhere around the Island.

In September, 1995 the Kelp Forest Monitoring Design Review Workshop was held. This workshop was the next step in analyzing the results of a temporal trends analysis of the 1982 through 1993 kelp forest monitoring data that was conducted by the firm, Ecometrics in 1994. The workshop was attended by biologists, statisticians, and managers experienced in long-term ecological studies and coastal ecosystem monitoring. The participants were asked to evaluate the analysis and to apply their expertise to improving the program. The results of this workshop were published in a technical report (Davis et al., 1996).

INTRODUCTION

The waters of Channel Islands National Park and Channel Islands National Marine Sanctuary contain one-third of southern California's kelp forests (Davies, 1968). The brown algae, *Macrocystis pyrifera*, is the primary constituent of these kelp forests and over 1,000 species of macro flora and fauna can be found here (Woodhouse 1981, J.M. Engle Pers. Comm.). Many other species, while not residents of the kelp forest community, are dependent upon the existence and productivity of kelp forests. The kelp forest serves as food, shelter, substrate, and a nursery to resident as well as migratory species. Kelp forest detrital flux provides an important source of nutrients to nearby rocky shore, sandy beach, and estuary communities.

The kelp forests are essential to our commercial and sport fisheries as well as recreation and the associated tourist industry.

Channel Islands National Park consists of five of the eight California Channel Islands (San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara) and the submerged lands and waters within one nautical mile of each of the Islands. The Channel Islands National Marine Sanctuary overlaps the subtidal portions of the park, and its boundary extends six miles seaward from the Park Islands. Channel Islands National Park also bears the designation of International Biosphere Reserve and State of California Areas of Special Biological Significance. The State of California maintains jurisdiction over the resources within the Park and manages them through the California Department of Fish and Game.

The federal law which established Channel Islands National Park (16-USC-410) mandated the development of inventories and monitoring of natural resources in the Park. Kelp Forest Monitoring is part of the long-term ecological monitoring program at the Park which is designed to measure the health of the ecosystems. By determining the limits of normal variation and diagnosing abnormal conditions we hope to prescribe remedial action through management recommendations.

Following a five year design study that began in 1982, the Kelp Forest Monitoring Program was implemented in 1987 by the Park's resource management division, using the protocol established during the design phase. Monitoring design rationale is discussed in Davis and Halvorson (1988). Preliminary results and specific design considerations can be found in reports written by Davis (1985, 1986). Richards, Gramlich, and Davis (in prep.), describe monitoring efforts and results for 1982-1989. Richards, Avery, and Kushner 1993), Richards, Kushner, and Avery (1993), Richards and Kushner (1994), Kushner et. al. (1995), Kushner, Lerma, and Richards (1995) describe the monitoring efforts from 1990 to 1994 respectively.

This report summarizes the monitoring efforts and results from 1995, our fourteenth year of monitoring. It is hoped that these reports well provide some insight into kelp forest dynamics and stimulate further research into the long-term trends and changes in this near-shore ecosystem. We have highlighted some of the most important observations, and tried to provide a characterization for each site. Organisms are referred to by genus and species, except in the abstract and executive summary where both scientific and common names are used. Common names are cross referenced to their scientific names in Table 1. Since the design of the kelp forest monitoring project, several genus and species names have been changed. For consistence with earlier reports we are continuing to use nomenclature from Morris Abbott and Haderlie, 1980, Abbott and Hollenberg, 1976, and Eschmeyer et al. 1983. A few of the name changes that are becoming more common are cross referenced in Table 1.

METHODS

Population dynamics of 68 taxa or categories of algae, fish, and invertebrates (Table 1) were measured at 16 permanent sites (Table 2) around the five Park islands (Figure 1). Site and species selection criteria are provided in the Kelp Forest Monitoring Handbook (Davis, 1988). Sites were monitored between June and September of 1995.

Each site is marked by a 100 m long transect affixed to the seabed. The sampling techniques employed to gather information on population dynamics are summarized in Table 3. Techniques are described in Davis, 1988 and have not been modified except for the addition of Artificial Recruitment Modules (ARMs). At each station, 40 paired stratified 1 m x 1 m quadrats and 24 paired stratified 3 m x 10 m band transects were used to determine densities and distribution of discrete benthic organisms; 1000 random non-adjacent points (random point contacts - RPCs) were used to determine percent cover of encrusting invertebrates, algae and substrate composition; 2 m x 3 m x 100 m fixed transects were used to determine fish abundance; video taped transects provide a record of the site appearance' and size frequency measurements were collected to determine age structure, population recruitment, and growth rates. A general species list was established for each site, noting presence/absence and relative abundance for all recognizable species. Artificial recruitment modules (ARMs) were used at ten of the sites to measure recruitment and population structure.

Animals measured for the natural size frequency distributions were located using a band transect type search method except at two Santa Barbara Island sites where quadrats were used to locate *Strongylocentrotus purpuratus* because of their high densities. The band transect type search method is when a diver swims approximately 5-10 m x 2 arms length transects perpendicular to the main transect. These transects are spaced approximately 5-10 m apart along the main transect depending on the abundance of the target species. The general search method is when a diver swims in the area around the transect and measures all the emergent animals of the target species they encounter. The quadrat method is when a quadrat is placed in an area where the target species occurs, and all of individuals of that species are measured within the quadrat. All methods of sampling are non-destructive (the substrate is undisturbed, and only emergent animals are measured), except sea urchins are removed so that any sea urchins under their spine canopy can be measured.

In addition to the standard (natural habitat) size frequency measurements, size frequency measurements of indicator species found in the ARMs were also collected. These ARMs are rock cribs, consisting of 20 half-sized concrete blocks (40cm L X 20cm W X 10cm H) stacked five high and enclosed in a wire mesh frame. The wire cage dimensions are 60cm L X 60cm W X 50cm H and the mesh size is 5cm X 10cm. Each ARM

provides a standardized surface area of about 24 m^2. The ARMs are sampled by opening up the cage, and removing each brick while carefully looking for animals. Animals measured include: *Patiria miniata*, *Pisaster giganteus*, *Pycnopodia helianthoides*, *Strongylocentrotus franciscanus*, *S. purpuratus*, *Lytechinus anamesus*, *Cypraea spadicea*, *Astraea undosa*, *Hinnites giganteus*, and all *Haliotis spp.*. *Parastichopus parvimensis* were counted and sizes estimated (greater or less than 10cm), but this data has not been incorporated in the database. Due to time constraints underwater, when more than 200 individuals of a particular species were measured, we sometimes discontinued measuring that species in the remaining ARMs at the site. The number of ARMs from which a particular species was measured is listed at the top of their distribution in Appendix H. Size frequency measurements were taken underwater, or the animals were brought to the surface to be measured then returned into the ARM from which they were removed.

STOWAWAY$^{TM.}$ temperature loggers were deployed at all sites. Loggers were encased in underwater housings that are attached to stainless steel thread rods cemented to the bottom at each site. HOBOTEMP$^{TM.}$ temperature loggers were also deployed at each site as a backup in case of logger failure. The HOBOTEMP$^{TM.}$ loggers were programmed for 360 days , taking a reading every 4.8 hours. The STOWAWAY$^{TM.}$ loggers were programmed to record the mean temperature of 100 temperature readings per hour for 670 days. Because our sampling is conducted June - September we will present 12 months of temperature data from June 1, 1994 to May 31, 1995.

STATION RESULTS AND DISCUSSION

Sampling was completed at all 16 monitoring sites by 34 divers (Table 5) during seven five-day cruises between June and September. A total of 754 dives with 567.5 hours of bottom time were completed.

A brief description of each site is included with the station results below. Complete data summaries from the sampling protocol are listed in the appendices. Means for quadrats are in Appendix A, and represent average counts obtained from 40 paired stratified random 1 m X 1 m quadrats. Means for band transects are in Appendix B, and represent average counts obtained from 24 paired stratified random 3 m X 10 m transects. Means for random point contacts are in Appendix C, and represent average percent cover for a given organism or substrate at 25 random locations along the transect. Forty points from each quadrat (1,000 points total) are used to determine percent cover of selected organisms and substrate within one meter of the bottom. Percent cover may total more than 100% due to layering. Means for fish transects are in Appendix D, and represent the average of counts obtained on each pass by divers swimming the entire 100 m transect and observing fishes passing within a 2 m X 3 m “window” centered on the line. Cases listed refer to the total number of passes made during that sampling. All counts were conducted

between 0900 and 1500 hours unless mentioned as being different. Natural habitat size frequency distributions for invertebrates other than gorgonians and *Allopora californica* are in Appendices E. Gorgonian and *Allopora californica* size frequency distributions are in Appendix F. *Macrocystis pyrifera* size frequency distributions are in Appendix G. Size frequency measurements taken from the ARMs were kept separate from the natural habitat measurements and their distributions are in Appendix H. Species lists for all locations are in Appendix I. The temperature data collected by the temperature loggers are presented in graphic form for each site where data was available in Appendix J. Video transects were completed for all locations. A summary of the 1995 status of each site is presented in Table 4.

Temperature data were collected the from STOWAWAY™ temperature loggers at 15 of the 16 sites (Appendix J). The underwater housing which contained the temperature loggers at Yellowbanks, Santa Cruz Island was missing. The stake to which the housing was attached was bent over, so we assume the housing was removed by a large physical force such as an anchor. At the remaining 15 sites, all of the STOWAWAY™ temperature loggers worked well, however two of the 15 backup HOBOTEMP™ temperature loggers failed. The data from only the STOWAWAY™ temperature loggers were archived and used for this report. A recreational SCUBA diver located the housing that contained the temperature loggers at Fry's Harbor, Santa Cruz Island. The diver noted that the housing was just lying on the bottom when found. He brought it to the surface, opened it up, noted the address inside, and returned it to us about a week later. We were able to deploy the unit several weeks after this. Only three weeks of data were lost at this site. Stainless steel dog tags reading "PLEASE DO NOT DISTURB TEMPERATURE RECORDING DEVICE NATIONAL PARK SERVICE INFO 805-658-5773" were attached to all of the temperature logger housings. We hope that these tags will satisfy a diver's curiosity if they happen upon one so they don't feel compelled to remove the loggers.

Location: Wyckoff Ledge, San Miguel Island

1995 sampling dates: 8/22, 8/23, 9/28

1995 status: Mature kelp forest with dense understory of red and brown algae.

Macrocystis pyrifera canopy cover was lower than last year. Canopy cover was estimated at 40% this year, and was predominately on the east and west ends of the transect with relatively little along the middle portion of the transect. Large adult *M. pyrifera* plants were not present along the middle section of the transect, explaining the lack of cover. Overall, large and small adult *M. pyrifera* plants were common along the transect with a density of 0.38/m^2. Large dead *M. pyrifera* holdfasts were common along the transect. Juvenile *M. pyrifera* were common with a density of 0.28/m^2. Overall bottom coverage of *M. pyrifera* was relatively low for this site, 14%. However, understory algae was diverse, abundant, and often several layers

thick. The most abundant understory brown algae was *Desmarestia spp*. covering 32% of the bottom on August 23. Although still abundant, there appeared to be less *Desmarestia spp*. during our September 28th visit. The next most abundant understory brown algae was *Cystoseira spp*., it covered 11% of the bottom. Understory red algae were abundant consisting of many species; *Cryptopleura violacea*, and *Gigartina corymbifera* were noticeably abundant as were several other species. Miscellaneous red algae was recorded at 81% cover. *Gigartina spp*. cover was recorded at 19%, its highest coverage recorded at this site. *Gelidium spp*. was common along the transect with a coverage of 0.6%. *Pterygophora californica* was common with a density of 0.2/m^2. Articulated and encrusting coralline algae covered 19% and 47% of the bottom respectively. Size frequencies, RPCs, quadrats, and band transects took much longer than normal because of the additional time it took to search for index species under the thick understory of algae.

Hydroids (mostly *Aglaophenia latirostris*) and the worm *Pista elongata* were the most common miscellaneous invertebrates on RPCs. This category covered 8.5% of the bottom. Old/loose sand tubes from *Phragmatopoma californica* were abundant in the low/sandy areas of the transect. Their coverage decreased to 0.6% from 6.4% cover in 1994. *Diopatra ornata* were common covering 10% of the bottom. Bryozoans were also less abundant than last year, combined their coverage was 5.5%. Tunicates were common covering 4.1% of the bottom. *Tealia lofotensis* were abundant with a density of 0.18/m^2, and were most common on large rocks. *Tethya aurantia* were common with a density of 0.072/m^2. Gorgonians are uncommon at this site, only two *Lophogorgia chilensis* were found on band transects.

Mysids were abundant in thick swarms, and were the main factor for decreased visibility near the bottom on August 23rd. The kelp isopod, *Idotea resecata*, were abundant among the *Macrocystis pyrifera* stipes near the surface.

Kelletia kelletii were moderately abundant, and were counted on both quadrats and band transects. There densities were 0.38/m^2 and 0.23/m^2 respectively. Both large and medium sized whelks appeared equally abundant. *Astraea gibberosa* were relatively abundant, but had a patchy distribution. Olive snails, *Olivella biplicata*, were common in the sandy areas on the west end of the transect. *Haliotis rufescens* were relatively common, and 16 (0.022/m^2) were found on band transects. On September 29th, six very fresh *H. rufescens* shells were found within two meters of either side of the transect, indicating what appears to be high recent mortality. This mortality most likely occurred since the previous visit on August 23rd. The shell sizes were 162, 168, 176, 182, 184, and 209 mm. We were not able to determine the cause of mortality from the shells.

Patiria miniata were common along the transect with a density of 1.1/m^2. *Pisaster giganteus* were common on the rocky outcrops, but uncommon directly along the transect with a density of 0.025/m^2. *Pycnopodia*

helianthoides were relatively uncommon and only one was found during band transects this year (0.0014/m^2). *Strongylocentrotus franciscanus and S. purpuratus* were common, but confined to cracks and crevices. Their densities were 0.5/m^2 and 0.33/m^2 respectively.

Fish were abundant as usual for this site. Most abundant, were the large schools of *Aulorhynchus flavidus* (tubesnouts), which were present over the entire transect. Juvenile rockfish, *Sebastes spp*., were abundant along the entire transect. The most abundant species appeared to be *Sebastes paucispinis* (Bocaccio). Large male and female *Semicossyphus pulcher*, *Sebastes caurinus* (copper rockfish), *S. miniatus* (vermillion rockfish), and *Oxylebius pictus* (painted greenlings) were all common. One P*leuronichthys coenosus* (c-o turbot), one *Sebastes serriceps* (treefish), and a small *Paralichthys californicus* (California halibut) were observed.

Location: Hare Rock, San Miguel Island

1995 sampling dates: 8/23, 8/24, 9/28
1995 status: *Strongylocentrotus franciscanus* barren.

This site has changed little and continues to be dominated by *Strongylocentrotus franciscanus*. No *Macrocystis pyrifera* was present along or near the transect. The transect was devoid of macroalgae, except for a few small patches on the tops of large rocks. This algae consisted mostly of *Desmarestia spp.* and *Gigartina sp.*. One adult *Eisenia arborea* was observed, but was not present on quadrats. Filamentous brown and red algae were common, but patchy along the transect. A small amount of filamentous green algae was also present. Much of the bottom was either bare or covered with encrusting coralline algae. These categories covered 34% and 44% of the bottom respectively. There were many breaks in the line as usual for this site. Unfortunately, there was a break in the transect line between the zero and ten meter eyebolts, and the meter tape was laid out from 10 to 100 meters, and then 10 meters west of the transect. Because this transect is extremely uniform, the ten meters off the transect is unlikely to have any significant impact on the data. Furthermore, these ten meters were very similar to the first ten meters of the transect, *Strongylocentrotus franciscanus* barrens.

The most common miscellaneous invertebrates on RPCs were terebellid worms, and the worm, *Dodecaceria fewkesi*. This category covered 6.5% of the bottom. *Corynactis californica*, *Balanophyllia elegans and Astrangia lajollaensis* were all common. Their coverage's were 5.4%, 2.3% and 3.5% respectively.

Strongylocentrotus franciscanus dominated this site with a density of 13/m^2. Except for the very small juvenile *S. franciscanus* under the spine canopy of conspecifics, the adult *S. franciscanus* were out in the

open and rarely observed in crevices. *S. purpuratus* were often in small depressions or out in the open, and their density was 1.08/m^2. *Patiria miniata*, *Pisaster giganteus*, and *Pycnopodia helianthoides* were moderately abundant along the entire transect. Their densities were 2.4/m^2, 0.45/m^2 and 0.051/m^2 respectively.

Mysids were abundant on the bottom. Few barnacles were observed along the transect, last year they were abundant over much of the transect. Invasive sampling for *Haliotis rufescens* was conducted in the cobble areas around the transect, especially inshore towards Hare Rock. Small *H. rufescens* were common (18 were found) under the cobble, but most of the abalone were greater than 25mm, indicating little recruitment this year. K*elletia kelletii* were rare along the transect. *Cypraea spadicea* were common with a density of 0.5/m^2. *Aplysia californica* were also common with a density of 0.21/m^2.

Juvenile *Sebastes spp*. (rockfish), *S. mystinus*, *S. atrovirens*, *S. serranoides*, female *Semicossyphus pulcher*, *Embiotoca jacksoni*, *Damalichthys vacca*, and large *Chromis punctipinnis* were all common along the transect. One *S. serriceps*, as observed along the transect. *Coryphopterus nicholsii* were common with a density of 0.45/m^2.

Location: Johnson's Lee North, Santa Rosa Island

1995 sampling dates: 7/26, 9/27
1995 status: Mature kelp forest.

Macrocystis pyrifera was abundant and its canopy covered 100% of the transect during slack tide. Most of the adult *M. pyrifera* plants were large and widely spaced, typical of a mature kelp forest. Approximately half of the fronds appeared healthy, while the other half were covered with epiphytic bryozoans (*Membranipora* type) and hydroids (*Obelia* sp.) Juvenile *M. pyrifera* were common. Adult and Juvenile *Macrocystis pyrifera* densities were 0.6/m^2 and 0.85/m^2 respectively. Large holdfasts from dead *M. pyrifera* plants were common along the transect. Live *Pterygophora californica* and the stipes of dead sea palms were common along the transect. *Laminaria farlowii* was common (0.15/m^2) and about half of the plants found in quadrats were juveniles. *Cystoseira spp*. covered 5.6% of the bottom. On September 27th, *Desmarestia spp.* was moderately abundant along the transect, however there was little present on our July 26th visit when RPCs were conducted (0.1%). Foliose red algae was common, covering 35% of the bottom. Overall, this site appeared similar to the past several years, except the bottom appeared scoured in the low lying areas, and there was more silt and sand than usual. There was a layer of fine silt over much the bottom that was easily stirred up, and a 1-5 cm layer of sand was present over much of the low lying areas

of the transect. Percent cover of sand increased to 7.4% (up 4.9% from 1994), while rock decreased in cover.

The most common miscellaneous invertebrate on RPCs were hydroids (mostly *Sertularella sp./Sertularia sp.* and *Aglaophenia latirostris*). This category covered 24% of the bottom. Tunicates were also moderately abundant covering 11% of the bottom. The most common tunicate was *Pycnoclavella stanleyi*. Bryozoans combined covered 26% of the bottom. The most common bryozoan appeared to be *Bugula sp. (neritina?)*, and was abundant on the bottom. *Phragmatopoma californica* were abundant in almost every holdfast, and partly crushed sand tubes from dead *P. californica* were common in the low lying areas along the transect. These worms were recorded at 12% cover. *Tethya aurantia* were common with a density of 0.092/m^2.

Strongylocentrotus franciscanus and *S. purpuratus* were mostly found in deep crevices and under ledges. Their densities were 0.15/m^2 and 0.35/m^2 respectively. *Pycnopodia helianthoides* were moderately abundant with a density of 0.078/m^2. *Patiria miniata* and *Pisaster giganteus* densities were 0.45/m^2 and 0.33/m^2 respectively.

Haliotis rufescens were present under ledges and in crevices, but were patchy. Their density was 0.04/m^2. We have observed six or seven abalone that were about one meter east of the 73 m mark along the transect increase in size over the past six years. Most of these abalone were at least 175mm last year, this year only two were found. *Cypraea spadicea* were common with a density of 0.58/m^2.

Overall, fish were abundant along the transect. Adult *Sebastes atrovirens* were abundant along the entire transect. No *Paralabrax clathratus* were observed during the fish transects, but several large adults were observed along the transect. *Rhacochilus toxotes* (rubberlip surfperch), *Embiotoca jacksoni*, *E. lateralis*, and *Brachyistius frenatus* (kelp surfperch) were all common. The resident *Hypsypops rubicundus* at 73 m along the transect was again present with a nest. *Sebastes chrysomelas* (black and yellow rockfish) were common. Juvenile *Sebastes spp*. were common along the bottom and in the kelp canopy. Moderately sized schools of *Atherinops affinis* (top smelt) and *Trachurus symetricas* (jack mackerel) were present.

The ARMs were damaged from this year's storms. Four of the five ARMs at the north end of the transect moved little. The other ARM (#105) moved inshore about five meters and was functionally destroyed. This ARM was sampled, disassembled and its remaining intact bricks were used to replace broken bricks in other ARMs. The mangled cage and broken bricks were brought to the surface and disposed.

Only one of the middle group of ARMs was in its original location. Three other ARMs from this group were located about 10 m inshore of the transect. The ARM near the transect and two of the three ARMs inshore

of the transect were sampled for all indicator species. Most of the broken bricks from these ARMs were replaced with bricks from the disassembled ARM (#105). These three ARMs were relocated back to their original location next to the transect. Note that one of these three ARMs (#12/2342) was thought to have disappeared in 1993. This ARM contained three large introduced *H. rufescens* shells (142, 154 and 160mm) that probably died in 1993. It is possible these abalone were "crushed/died" when the ARM was moved inshore, probably bouncing along the bottom from the physical force of large waves. These three abalone were susceptible to this type of action due to their large that barely allowed them to fit between the bricks. This could be seen by the excessive wear on the dorsal side of their shells.

Three of the five ARMs on the south end of the transect were sampled for all indicator species. The remaining two were sampled for all indicator species except sea urchins. ARM #5/2395 had moved inshore and was moved closer to the transect where the other four ARMs were located.

New stainless steel number tags were placed on all ARMs to replace the corroding brass tags, and are listed below:

North group of ARMs		**Middle group of ARMs**		**South group of ARMs**	
old brass	new stainless	old brass	new stainless	old brass	new stainless
105	dismantled	no tag	2398	no tag	2393
7	2338	no tag	2343	no tag	2394
no tag	2339	3	2396	4	2392
no tag	2340	12	2342	3/333	2397
no tag	2341	crushed		5	2395

In the ARMs: Seven native *Haliotis rufescens* were found, measuring 26, 31, 50, 51, 73, 143, and 156mm. Only five (0.36/ARM) *Hinnites giganteus* were found, slightly lower than the last two years. The number of *Patiria miniata* increased to 3.4/ARM, greater than the last three years. Inversely, the number of *Pisaster giganteus* decreased to 0.64/ARM, lower than the last three years, and the mean size increased. *Pycnopodia helianthoides* were common, 18 were found in the 14 ARMs. The number of *Strongylocentrotus franciscanus* and *S. purpuratus* continued their gradual increasing trends. The numbers per ARM this year were 25 and 17 respectively. The mean size for *S. franciscanus* has gradually decreased over the last four years.

Location: Johnson's Lee South, Santa Rosa Island

1995 sampling dates: 7/25, 7/28, 9/26, 9/27

1995 status: Mature kelp forest with dense understory of red algae.

In July, the transect line was so overgrown with red algae, the hydroid, *Aglaophenia latirostris*, and buried by sand that it was almost impossible to see. There was only about 10 m of line that was actually visible over

the entire transect. *Macrocystis pyrifera* canopy cover over the transect was estimated at 35% at slack tide. This site was typical of a mature kelp forest with large, widely spaced adult *M. pyrifera* plants. Adult and Juvenile *M. pyrifera* densities were 1.0/m^2 and 1.9/m^2 respectively. Most of the fronds on the adult plants were covered with epiphytic bryozoans, *Membranipora sp.*, and the hydroid, *Obelia sp.*. *Pterygophora californica* and *Laminaria farlowii* were common. Several *Agarum fimbriatum* plants were present along the transect. One juvenile *Eisenia arborea* and one *Desmarestia sp.* were observed along the transect. Understory red algae was abundant and diverse covering much of the bottom. Miscellaneous red algae, mostly *Callophyllis spp.*, covered 69% of the bottom. *Gigartina spp.* covered 24% of the bottom. These coverage's were the highest recorded for this site. Much of the bottom was covered with a thin layer of silt that was easily stirred up. Both rock and cobble substrates decreased while sand substrate increased to 25% cover (from 12% in 1994).

Hydroids were abundant at this site, and were the most common miscellaneous invertebrate on RPCs. This category covered 27% of the bottom. *Obelia sp.* was abundant on the kelp fronds, and *Aglaophenia latirostris* was abundant on the bottom. Tunicates and sponges were abundant and diverse covering 3.0% and 5.0% of the bottom respectively. *Diopatra ornata* were abundant in patches in the low lying areas around the transect, their coverage was 14%. The sea anemones, *Tealia lofotensis*, *T. coriacea*, and *T. columbiana* were all common. *Lophogorgia chilensis* were moderately abundant with a density of 0.15/m^2.

Strongylocentrotus franciscanus and *S. purpuratus* continued to occur at low densities and were observed only in crevices. This made them difficult to access for size frequencies. We kept track of how many sea urchins we were able to access for size frequency measurements. Only 65 of the 142 *Strongylocentrotus franciscanus*, and 69 of the 144 *S. purpuratus* encountered were able to be measured. *S. franciscanus* and *S. purpuratus* densities were 0.98/m^2 and 1.1/m^2 respectively. Small *S. franciscanus* (20-30 mm) were common in crevices, under small rocks and in the spine canopy of larger conspecifics. Juvenile S. *purpuratus* were common under small rocks. Whole sea urchin tests were common and were probably the products of predation by *Pycnopodia helianthoides*. *Patiria miniata* were abundant, and *Pisaster giganteus* and *Pycnopodia helianthoides* were common. Their densities were 2.4/m^2, 0.15/m^2 and 0.054/m^2 respectively.

Megathura crenulata were uncommon, only one was observed on band transects. *Haliotis rufescens* were relatively common under ledges. Their density was 0.014/m^2. The large *H.* rufescens near the north end of the transect under a small ledge was observed, this abalone has been there for the past several years. Abalone shells were collected, measured and disposed of off the transect. The nudibranchs, *Navanax inermis* and *Hermissenda crassicornis* were common.

Oxyjulis californica, *Atherinops affinis*, and *Chromis punctipinnis* were all common. Female *Semicossyphus pulcher* were common and several males were observed. *Paralabrax clathratus*, and adult and juvenile *Sebastes serranoides* were observed. *Damalichthys vacca* were more common than *Embiotoca jacksoni* and *E. lateralis*, but all were present along the transect. *Sebastes chrysomelas*, and *S. caurinus* were relatively common. *Coryphopterus nicholsii* were common (0.38/m^2) and four *Alloclinus holderi* (0.1/m^2) were observed on quadrats.

Only two of the seven ARMs were located intact near where they were placed. An additional ARM was located near these two, but only had several bricks left in it. Two empty ARM cages were located about 50 meters south of where they were placed. Unfortunately, we were not able to locate these cages again for salvaging. The remaining two ARMs or parts of, have not yet been located, but many bricks were scattered about the bottom.

The two intact ARMs (115 and no #) were sampled for all indicator species. One of these ARMs was upside down, the other on its side, and one layer of brick in each of these was buried in sand. A third ARM (#110) only had about eight bricks left in it and was falling apart. This ARM was repaired. These three ARMs were moved to an area that will hopefully be more protected from a large south swell. This area is about 10 meters east of the 62 meter mark along the transect. A new cage was deployed and the bricks that were scattered about were used to fill this cage. This ARM was placed near the others. There are now four ARMs at this location. New number tags were attached to the ARMs, and are listed below:

Old brass tags	**New Stainless steel tags**
110	2335
115	2336
no tag	2337
new cage	2334
ARM is missing	-
ARM is missing	-
ARM is missing	-

In the two ARMs that were sampled: Two *Haliotis rufescens* were found (36, and 126mm). No *Hinnites giganteus* were found. *Patiria miniata* were abundant and were of a medium size of 46mm. *Strongylocentrotus franciscanus* were common, and none less than 25mm were found. Only one *S. purpuratus* was found.

Location: Rodes Reef, Santa Rosa Island

1995 sampling dates: 8/21, 8/22

1995 status: Open area with a moderate amount of understory red algae.

There was no *Macrocystis pyrifera* along the transect, however there were several small plants about 10 m west of the west end of the transect. *M. pyrifera* canopy was observed several hundred meters away. Except for the lack of *M. pyrifera*, this site appeared similar to last year. Miscellaneous red algae was abundant covering 49% of the bottom. Much of this algae was growing on top of the abundant and dense worm beds composed of *Chaetopterus variopedatus* and *Diopatra ornata* on the eastern end of the transect. *Laminaria farlowii*, *Agarum fimbriatum*, and *Desmarestia spp.* were all present, but uncommon along the transect. *Cystoseira spp.* was common, and some plants were as tall as 10 meters. Most of these plants were several meters from the transect, and none were encountered during RPCs. Encrusting coralline algae was moderately abundant along the eastern half of the transect, but uncommon on the western half. Its coverage was recorded at 41%. Sand covered 19.2% of the transect, mostly on the eastern half.

The most common miscellaneous invertebrates on RPCs were the worms *Chaetopterus variopedatus* and *Pista elongata*, hydroids were also common. This category covered 23% of the bottom. *Chaetopterus variopedatus* beds were abundant on the eastern half of the transect as they were last year. *Diopatra ornata* were common covering 3.6% of the bottom. On the rocky/western half of the transect *Astrangia lajollaensis* and *Balanophyllia elegans* were moderately abundant. Their coverage's were 6.1% and 2.1% respectively. *Tealia lofotensis* were common on the tops of rocks. *T. coriacea* and *T. columbiana* were also common. *Lophogorgia chilensis* were uncommon, and no other gorgonians were present. Bryozoans combined covered 5.9% of the bottom. *Tethya aurantia* were abundant with a density of 0.17/m^2.

Both *Strongylocentrotus franciscanus and S. purpuratus* were common along the western/rocky half of the transect. Usually sea urchins at this site are in crevices, but this year many were out in the open. Small *S. franciscanus* were common under the spine canopy of their conspecifics, many of which were large. *S. purpuratus* were less abundant than *Strongylocentrotus franciscanus*. Their densities were 3.1/m^2 and 5.6/m^2 respectively. Several *Lytechinus anamesus* were found on band transects, but were rare. *Patiria miniata* were abundant (2.2/m^2) along the entire transect. *Pisaster giganteus* were abundant (0.3/m^2) on the western/rocky half of the transect, but most were small. Large and small *Pycnopodia helianthoides* were common (0.029)/m^2. *Dermasterias imbricata* (leather stars), were common. *Parastichopus parvimensis* were present along the western/rocky half of the transect, but were uncommon and none were found during quadrats. Along this end of the transect, the small sea cucumber, *Cucumaria piperata*, were abundant.

Kelletia kelletii were abundant along the eastern/sandy half of the transect. Several large (greater than 110mm), but no small individuals were found. Their density was 0.16/m^2, and *K. kelletii* measured for size frequencies were located within one meter of the line. Several *Aplysia californica* were observed, but none were observed during band transects. *Megathura crenulata* were common (0.017/m^2). One large *Haliotis*

rufescens (198mm) was observed about 12 meters from the transect. Two small and one medium (25, 31 and 93mm) sized *H. rufescens* shells were found, indicating some recent recruitment. Note that several very small (<10mm) *H. rufescens* were found in 1994, indicating the same. The nudibranchs, *Dendrodoris fulva* and *Phidiana pugnax* were common.

Overall fish were abundant and diverse. Male and female *Semicossyphus pulcher* were abundant. Adult *Sebastes caurinus*, *S. mystinus*, *S. serranoides*, *S. chrysomelas*, and juvenile *Sebastes spp.* were all common. Large and small painted greenlings, *Oxylebius pictus* were abundant. Adult *Damalichthys* vacca, *Rhacochilus toxotes*, *Embiotoca jacksoni*, and *E. lateralis* were all common. Juvenile *E. jacksoni* and *E. lateralis* were also common. Only one set of fish transects were conducted this year due to unsafe sea conditions during our second attempted to visit this site.

New transects stakes are needed for this transect. Currently there are only four intact stakes one at each end of the transect and at 10 and 30 meters. There is also one stake at 71 meters which doesn't have a top due to corrosion.

Location: Gull Island South, Santa Cruz Island

1995 sampling dates: 6/21, 6/22, 8/10
1995 status: Sparse mature kelp forest.

Macrocystis pyrifera canopy coverage was estimated at 5% in June. Adult *M. pyrifera* plants were relatively large and widely spaced with a density of 0.05/m^2. Although the plants were relatively large, they formed little canopy at the surface. Only 58 plants were found within five meters of either side of the transect for size frequencies Juvenile *M. pyrifera* was common growing on the tops of rocks mostly on the southern half of the transect. Juvenile density was low, 0.1/m^2 along the transect. All of the *M. pyrifera* plants appeared healthy. Several small *Laminaria farlowii* plants were present along the transect, their density was recorded at 0.13/m^2. No *Eisenia arborea* was observed around the transect, however there were several dead sea palm stalks on the tops of rocks that were probably *E. arborea*. The brown alga, *Dictyota/Pachydictyon* was common. Red algae was common covering 12% of the bottom. Much of this algae consisted of *Rhodymenia pacifica* and *Iridaea sp.*. Articulated coralline algae was common on the tops of rocks, and encrusting coralline algae was abundant covering 51% of the bottom.

On RPCs, the most common miscellaneous invertebrates were hydroids, amphipod tube mats, and *Spirobranchus spinosus*. This category covered 22% of the bottom. Sponges (mostly a encrusting orange/red sponge, *Hymenamphiastra cyanocrypta* (cobalt blue sponge), and *Tethya aurantia*) and tunicates

were common and diverse, covering 0.9% and 3.0% of the bottom respectively. Bryozoans combined, covered 7.9% of the bottom. *Balanophyllia elegans* and *Astrangia lajollaensis* were moderately abundant covering 3.8% and 4.0% of the bottom respectively. *Allopora californica* density was recorded at 0.046/m^2. The worm, *Salmacina tribranchiata*, was present, but did not appear as abundant as last year. *Diopatra ornata* covered 2.6% of the bottom and were spatially abundant dominating the low-lying sandy areas around the transect. The hydroid, *Garveia annulata*, was abundant growing epiphytically on articulated coralline and *Gelidium purpurescens* on the large rock on the south end of the transect. The kelp isopod, *Idotea resecata*, brown flat worms, and a species of brown gamarid amphipod were moderately abundant on the *M. pyrifera* stipes.

Strongylocentrotus purpuratus density increased to 31/m^2, this is the highest density since 1990, and up from 14/m^2 in 1994. *S. purpuratus* were more abundant on the northern end of the transect, as is usual for this site. There were many juvenile S. purpuratus in the shallow areas inshore of the transect. Approximately 25 S. purpuratus were observed with wasting syndrome. *S. franciscanus* density also increased, and was recorded at 6.3/m^2. *Lytechinus anamesus* were common in the low-lying sandy areas, their density was 0.17/m^2. Whole sea urchin tests were common in small piles and were probably predated upon by *Pycnopodia helianthoides*. *P. helianthoides*, *Patiria miniata*, and *Pisaster giganteus* were all common with a densities of 0.0125/m^2, 1.3/m^2, and 0.50/m^2 respectively. *Parastichopus parvimensis* was common with a density of 0.63/m^2. A sea urchin fisherman was observed working several hundred meters to the north and later to the south of the transect.

Cypraea spadicea were common with a density of 0.48/m^2. The *Cypraea spadicea* in the artificial recruitment modules (ARMs) were often found brooding eggs. *Kelletia kelletii*, *Megathura crenulata*, and *Hinnites giganteus* were all common with densities of 0.043/m^2, 0.036/m^2, and 0.035/m^2 respectively. *Aplysia californica* were uncommon, only one was found on band transects. The kelp snail, *Norrisia norrisi*, were common in the kelp canopy. The nudibranchs, *Hermissenda crassicornis*, *Diaulula sandiegensis*, and *Mexichromis porterae* were all observed.

Female *Semicossyphus pulcher* were abundant and males were common. *Paralabrax clathratus*, *Sebastes serranoides*, and *S. serriceps* were all common. *S. atrovirens* were moderately abundant on the bottom along the transect. S*corpaena guttata* (California scorpionfish), were common on the bottom. Several adult *Sebastes mystinus* were seen and juveniles were common. Fish larvae, and juvenile *Sebastes spp.* were common among the kelp blades near the surface. *Coryphopterus nicholsii* were common with a density of 0.48/m^2.

Two of the five ARMs at each the north and south ends of the transect were sampled for all indicator species, and the remaining three for all indicator species except sea urchins. All ARMs in the middle group were sampled for all indicator species. One of the ARMs from the middle group (#26) was found about 10 meters away from the other ARMs. The lid was open and most of its bricks had fallen out. This module was rebuilt and placed near the others in this group. The nudibranch *Berthellina engeli* were common in the ARMs. Although all of the ARMs still had intact brass number tags, and we attached new stainless steel number tags. The new tag numbers are listed below:

North group of ARMs		**Middle group of ARMs**		**South group of ARMs**	
old brass	new stainless	old brass	new stainless	old brass	new stainless
20	2321	26	2327	25	2333
18	2319	29	2328	23	2329
16	2322	27	2325	22	2330
19	2323	28	2326	24	2331
17	2320	30	2324	21	2332

In the ARMs: One *Haliotis rufescens* measuring 21mm, and four *H. corrugata* measuring 20, 21, 27, and 31mm were found. *Cypraea spadicea* were common, but less abundant than last year. *Patiria miniata* and *Pisaster giganteus* were common. Only one *Pycnopodia helianthoides* was found in the 14 ARMs. *Strongylocentrotus franciscanus* were common, but about half as abundant as last year. The mean number per ARM was 26. *S. purpuratus* densities were similar to last year, 59/ARM.

Location: Fry's Harbor, Santa Cruz Island

1995 sampling dates: 6/19, 6/20, 9/26

1995 status: Open area with high densities of aggregating red sea cucumbers, *Pachythyone rubra* and the cup coral,*Astrangia lajollaensis*.

Macrocystis pyrifera continued to be absent at this site, and there was little other foliose algae along the transect. There were several adult and juvenile *Eisenia arborea* plants along the transect, and they were abundant in shallow water inshore of the transect. Several adult *Laminaria farlowii* were present on top of large boulders along the north end of the transect, but none were observed in quadrats. The red algae, *Fauchea sp.*, and brown algae, *Pachydictyon/Dictyota* were present along the transect. A filamentous red alga was also present. Miscellaneous red and brown algae covered 5.2% and 0.3% of the transect respectively. Encrusting coralline algae covered 40% of the bottom.

The worm, *Pista elongata*, hydroids (mostly *Obelia sp.*), amphipod tube mats, and *Lophogorgia chilensis* were the most common miscellaneous invertebrates on RPCs. This category covered 13% of the transect. *Astrangia lajollaensis* were abundant, covering 20% of the bottom. *Balanophyllia elegans*, and *Corynactis*

californica were common. *Lophogorgia chilensis* were abundant on the deeper side of the transect, their overall density was 0.12/m^2. One *Eugorgia rubens* (purple gorgonian) was observed. Miscellaneous bryozoans (mostly *Thalamoporella californica*) were common covering 4.5% of the bottom. *Diaperoecia californica* covered an additional 2.6%. Parchment tube worms, *Chaetopterus variopedatus*, were common on the deeper side of the transect. Red colored caprellid amphipods were abundant on some of the *Lophogorgia chilensis*.

Pachythyone rubra continued to dominate this site, covering 21% of the bottom. *Parastichopus parvimensis* were common, but their densities have declined over the past several years. Their density was recorded at its lowest level for this site, 0.13/m^2. This is well below the mean density at this site for the past 14 years (1.9/m^2). *Strongylocentrotus purpuratus* density was 13/m^2, the highest ever recorded at this site. This is substantially above the 14 year mean of 3.9/m^2. One *S. purpuratus* was observed with wasting syndrome. *S. franciscanus* density was 2.7/m^2. *Lytechinus anamesus* density was 1.7/m^2, and were more abundant on the deeper/offshore side of this transect. Large *Centrostephanus coronatus* (coronado urchins) were relatively common. *Pisaster giganteus* and *Patiria miniata* were common over the entire transect. Their densities were 0.13/m^2 and 0.65/m^2 respectively. One *Pycnopodia helianthoides* was observed along the transect. The stars, *Astrometis sertulifera*, and *Henricia leviuscula* were common. The Brittle stars, *Ophiothrix spiculata*, were moderately abundant along the southern half of the transect.

Astraea undosa density was 0.83/m^2. *Kelletia kelletii* were common on the deeper side of the transect. Their density was recorded at 0.017/m^2, and most were large. *Megathura crenulata* were abundant with a density of 0.14/m^2. *Aplysia californica* were uncommon along the transect and none were found during band transects. The nudibranchs, *Navanax inermis* and *Hermissenda crassicornis* were abundant along the transect. Two *Tritonia festiva* were observed. *Conus californicus* (Cone snails) were common in small groups laying eggs. *Cypraea spadicea* were common with a density of 1.0/m^2. Many of the cowries observed in the ARMs were observed brooding eggs on June 20th when the ARMs were sampled. One small (approximately 25 mm) fresh *Haliotis cracherodii* shell was found.

Overall, fish were abundant along the transect. Adult and juvenile *Chromis punctipinnis* were abundant. Small female *Semicossyphus pulcher* were abundant and several males were seen. Juvenile and adult *Paralabrax clathratus* were common, however adults were relatively uncommon for this site during our June visit. *Damalichthys vacca*, *Embiotoca jacksoni*, and *Rhacochilus toxotes* (rubberlip surfperch) were all common on the north end of the transect. One adult and one juvenile *Hypsypops rubicundus* were also observed on this side of the transect. *Oxyjulis californica* and *Halichoeres semicinctus* were common. Several *Sebastes atrovirens* were present along the transect. Smooth/Stripefin Ronquils, *Rathbunella hypoplecta*, *Oxylebius pictus* (painted greenlings) and *Alloclinus holderi* were all common. *Coryphopterus*

nicholsii were common with a density of 0.3/m^2. Small (about 25 cm) *Cephaloscyllium ventriosum* (swell shark) were abundant along the entire transect. One *Pleuronichthys coenosus* (C-O turbot) was seen. A large school of *Trachurus symmetricus* (jack mackerel) was observed. Juvenile *Sebastes spp*. were common along the bottom.

All seven ARMs were intact and sampled for indicator species. The bricks in the ARMs were covered with the worm, *Spirobranchus spinosus*, and the snail, *Amphissa versicolor*, was abundant. Small hermit crabs were also abundant utilizing the *A. versicolor* shells. ARM #181/2386 was found open during our September 26th visit. New stainless steel number tags were placed on the ARMs. See below:

Old brass tags	**New Stainless steel tags**
183	2385
181	2386
185	2387
186	2388
187	2389
182	2390
184	2391

In the ARMs: Two *Haliotis rufescens* measuring 25mm and 34mm, and one *H. corrugata* measuring 35mm were found. The number of *Hinnites giganteus* found, was lower than the last two years, and the mean size increased, possibly indicating less recruitment. Small *Pisaster giganteus* were common in the ARMs this year. This is the first time *P. giganteus* less than 80mm has been found in the ARMs at this site. The number of *Strongylocentrotus franciscanus* per ARM declined and their mean size increased. The number per ARM was 47 and the mean size increased to 17mm. The number and size of *S. purpuratus* remained similar to last year, 93/ARM with a mean size of 14mm.

On May 27, 1995 a recreational diver removed the underwater housing containing the temperature loggers from the site. The diver noted that the logger housing was found attached to the thread rod that was broken off at the base. The other part of the thread rod was still embedded in the epoxy at the site. On June 19, 1995 a new thread rod was installed and temperature loggers were deployed the following day.

Location: Pelican Bay, Santa Cruz Island

1995 sampling dates: 6/20, 8/9

1995 status: *Strongylocentrotus purpuratus* barrens.

This site has changed dramatically since last year. Except for approximately 19 adult *Macrocystis pyrifera* plants around the north end of the transect, the transect is devoid of kelp and is sea urchin barrens. Only

one *M. pyrifera* plant was observed on quadrats. The *M. pyrifera* plants on the north end formed a small canopy and appeared healthy. Juvenile *M. pyrifera* was present on the north end of the transect. There were also a small number of *M. pyrifera* plants about 12 meters east of the transect towards the north end. The brown alga, *Sargassum sp.* (probably *muticum*), was common on the north end and about 10 meters east of the transect. *Eisenia arborea* was rare along the transect, only one was counted during quadrats. Encrusting coralline algae covered 30% of the bottom. All other algae combined covered only 2.1% of the bottom. There was much bare substrate at this site, "covering" 55% of the bottom.

The most common miscellaneous invertebrates on RPCs were terebellid worms. This category covered 9.6% of the bottom. A diver in training conducted the last five RPCs and mistakenly counted *Strongylocentrotus purpuratus* as miscellaneous invertebrates. It was estimated that only several points landed on *Strongylocentrotus purpuratus*, so this error had minimal impact on this category. Bryozoan abundance has greatly decreased the last two years. This year they were uncommon, covering only 0.8% of the bottom. *Lophogorgia chilensis* were common on the offshore/deeper side of the transect. Their density was 0.085/m^2

Strongylocentrotus purpuratus were abundant and continued to increase in density. Their density was 44/m^2, the highest recorded density at this site. *S. franciscanus* and *Lytechinus anamesus* densities were 3.8/m^2 and 0.34/m^2 respectively. *Patiria miniata* and *Pisaster giganteus* were uncommon along the transect. *Parastichopus parvimensis* were common with a density of 0.55/m^2.

Aplysia californica were uncommon with a density of 0.0083/m^2. *Astraea undosa* were moderately abundant and *Kelletia kelletii* were common with densities of a density of 1.6/m^2, and 0.067/m^2 respectively

Adult *Chromis punctipinnis* were common, but no juveniles were observed. Adult *Paralabrax clathratus* were common and juveniles were relatively abundant. Adult and juvenile *Embiotoca jacksoni* were common. *Hypsypops rubicundus*, *Girella nigricans*, *Damalichthys vacca* and female *Semicossyphus pulcher* were all common. *Coryphopterus nicholsii* were common with a density of 1.33/m^2.

The seven ARMs were monitored for all indicator species. Two of the ARM cages were bursting at their seems, #2314 and #2316. These cages were poorly built, and were brought to the surface and rebuilt. New stainless steel tags were attached even though the slowly corroding brass tags were still intact. The old tag numbers and their associated new numbers are as follows.

Old brass tags	**New Stainless steel tags**
121	2312
116	2318

122	2313
123	2316
119	2317
118	2315
117	2314

This is the second year that ARMs have been monitored at this site. No *Haliotis sp.* were found this year. *Cypraea spadicea were* common. *Hinnites giganteus* recruitment was much lower than last year with a mean number per ARM being 0.71. The mean size also increased to 33mm. *Pisaster giganteus* were more abundant than last year, and most were small, less than 40mm in radius. *Strongylocentrotus franciscanus* and *S. purpuratus* were both about half as abundant as last year, and their mean sizes increased. The number of *S. franciscanus* per ARM was 24 with a mean size of 21mm, and *S. purpuratus* decreased to 88/ARM with a mean size of 24mm.. Four *Centrostephanus coronatus* were found this year. Like the other sea urchins these also increased in size this year.

Location: Scorpion Anchorage, Santa Cruz Island

1995 sampling dates: 8/9, 8/11, 9/15

1995 status: *Strongylocentrotus purpuratus* barrens.

The immediate area around the transect appeared similar to previous years with high densities of *Strongylocentrotus purpuratus*. However, moderate numbers of both juvenile and small adult *Macrocystis pyrifera* plants were present along the last 25 m of the transect. *M. pyrifera* canopy over the transect was estimated at 5%, and densities of adult and juveniles were 0.25/m^2 and 0.35/m^2 respectively. Patches of *Dictyota/Pachydictyon* brown alga were common along the east end of the transect. A filamentous green alga formed thin mats on some of the sand patches along the transect, and was responsible for all of the miscellaneous green algae recorded on RPCs, covering 1.0% of the bottom. Filamentous brown and red algae were common along the latter part of the transect covering 2.4% and 2.3% of the bottom respectively. Encrusting coralline algae was abundant covering 64% of the bottom. Bare substrate covered 27% of the bottom.

The *M. pyrifera* forest that was present around the transect last year has matured. The forest now consists of large widely spaced plants compared to lasts years high density of small plants. *Strongylocentrotus purpuratus* were moderately abundant in these areas, but were confined to crevices.

The most common miscellaneous invertebrates on RPCs were worms, *Spirobranchus spinosus* and brittle stars, *Ophiothrix spiculata*. This category covered 10% of the bottom. The brittle stars we believe to be

Amphipholis squamata, were moderately abundant in the tiny crevices of the rocks along the bottom. *Serpulorbis squamigerus* were common along the transect, covering 3.5% of the bottom.

Strongylocentrotus purpuratus dominated this site with a density of 49/m^2. However, *S. purpuratus* were less abundant at the west end of the transect, where most of the macroalgae is present. Juvenile *S. purpuratus* were common, and both adults and juvenile were out in the open, not confined to crevices. Half meter square quadrats were used to locate *S. purpuratus* for size frequencies. *S. franciscanus* were also out in the open and were recorded at their highest densities since 1989 at 1.6/m^2. *Lytechinus anamesus* were common along the eastern half of the transect. No sea urchins with wasting syndrome were observed this year. *Pisaster giganteus* were rare. *Patiria miniata* and *Parastichopus parvimensis* were common with densities of 0.33/m^2 and 0.23/m^2 respectively.

Aplysia californica and *Megathura crenulata* were moderately abundant. Their densities were 0.067/m^2 and 0.092/m^2 respectively. Adult and juvenile *Astraea undosa* were abundant with a density of 3.4/m^2. Eight *Panulirus interruptus* were observed on band transects (0.011/m^2).

Adult *Chromis punctipinnis* and *Oxyjulis californica* were common. Adult and juvenile *Paralabrax clathratus* were common. Adult and large juvenile *Hypsypops rubicundus* were also common. One *Sebastes serranoides* was observed during fish transects. *Semicossyphus pulcher* were relatively uncommon, and only one female was observed during fish transects. Adult and juvenile *Coryphopterus nicholsii* were common in quadrats having a density of 0.58/m^2.

Five of the seven ARMs were located about 10 meters north of the west end of the transect. Four ARMs (194/2380, 103/2381, 104/2379, and 2383) were sampled for all index species. ARM 2383 was on its side. ARM 106/2384 only had about half of it bricks inside (the remainder were scattered about), and was not sampled. A large pile of bricks were present along the west end of the transect. Two new cages with some new and some bricks from this pile were deployed. All but two of the ARMs were moved next to large rocks where we thought they would be more protected from large swell. The ARMs are now located about 10 meters north of the west end of the transect. This area consists of a mature kelp bed, even though it is only about 10 meters away from the transect which is sea urchin barrens.

In short, four ARMs were sampled for all indicator species, and the remainder of the ARMs were repaired or rebuilt. There are currently seven intact ARMs at this site, however there are still several broken bricks in several of the ARMs. The broken bricks that were replaced were brought to the surface and disposed. New number tags were placed on the ARMs and are listed below.

Old brass tags	New Stainless steel tags
new ARM	2378
104	2379
194	2380
103	2381
new ARM	2382
no tag	2383
106	2384

In the four ARMs that were sampled: No *Haliotis sp.* were found. There were fewer *Hinnites giganteus* per ARM this year, and only three were less than 20mm were found. Sea stars were relatively uncommon in the ARMs. The number of *Strongylocentrotus franciscanus* and *S. purpuratus* per ARM was similar to last year, but there were fewer recruits (<14mm) of both species this year. Similarly, mean size increased.

Location: Yellowbanks, Santa Cruz Island

1995 sampling dates: 7/27, 7/28, 9/13

1995 status: Mature kelp forest.

Overall, this site has changed little in previous years. The site is described as a mature kelp forest with a thin canopy, and an abundance of understory brown algae. In July, *Macrocystis pyrifera* canopy covered an estimated 60% of the transect. The *M. pyrifera* plants were large and widely spaced. No juvenile *M. pyrifera* were observed on quadrats, but several juveniles were present along the transect. Approximately 50% of the *M. pyrifera* fronds appeared healthy, while the other 50% were tattered and/or had epiphytic bryozoans (*Membranipora sp.*), and hydroids (*Obelia sp.*) growing on them. Adult *M. pyrifera* density was 0.25/m^2. Adult *Laminaria farlowii* and *Pterygophora californica* were moderately abundant, however juveniles were rare. Their densities were 0.58/m^2 and 2.0/m^2 respectively. *Cystoseira sp.* was common covering 13% of the bottom. *Eisenia arborea* was present but not as abundant as other understory brown algae. Miscellaneous red algae covered 6.6% of the bottom, and consisted of both filamentous red algae and a low growing foliose type. Articulated coralline algae was abundant on the tops of rocks, covering 23% of the bottom. Fine silt was present over the entire transect and was easily stirred up.

The most common miscellaneous invertebrates on RPCs were hydroids, mostly *Aglaophenia latirostris*. This category covered 14% of the bottom. Bryozoans were abundant and diverse directly along the transect. They consisted mostly of *Thalamoporella californica*, *Membranipora sp.*, *Hippodiplosia insculpta*, *Diaperoecia californica*, *Phidolopora pacifica*, and *Bugula neritina*. Combined they covered 14% of the bottom. The *Tethya aurantia* often appeared brown at this site due to the abundance of silt that covered some of them. This made them difficult to see during band transects and size frequencies.

Strongylocentrotus franciscanus and S. purpuratus were common, but were confined to crevices. Their densities were 0.63/m^2 and 11/m^2 respectively. *Lytechinus anamesus* were common (0.34/m^2) on the sand on the inshore side of the transect. They were small and difficult to see because of pieces of debris attached to them. Sea stars were uncommon. *Parastichopus parvimensis* were common with a density of 0.40/m^2.

Astraea undosa were present along the entire transect with a density or 0.50/m^2, and were large with a mean size of 89mm. Kelp snails, *Norrisia norrisi*, were common. *Kelletia kelletii* were common with a density of 0.058/m^2. No *Haliotis corrugata* were observed on band transects. Small (less than 75 mm) fresh *Haliotis corrugata* shells were common near the transect, indicating recent recruitment and subsequent mortality. Abalone size frequency measurements were conducted within the transect area (100x20m. Eight *H. corrugata* , all less than 155mm were located. Additional area, adjacent to the transect line, was surveyed to supplement abalone size frequency data. Seven *H. corrugata* were measured in this supplemental survey, but these were not included in database since they were located off the transect (more than 10m away). These seven abalone were measured at 116, 120, 129, 129, 140, 145, and 149 mm.

Female *Semicossyphus pulcher*, adult *Paralabrax clathratus*, and male and female *Halichoeres semicinctus* were all common. *Oxyjulis californica* were also common, but most were above the transect. *Coryphopterus nicholsii* were common with a density of 0.45/m^2.

All three groups of five ARMs along the transect were intact. The additional group of five ARMs about 20 meters east of the transect were also intact except for one lid which was found several meters away from the module. Visibility was greatly reduced when sampling the ARMs due to the large amount of silt at this site.

The five ARMs east of the east end of the transect were sampled only for abalone, and none were found. Two ARMs from the east and west groups, and four from the middle group were sampled for all indicator species. The remainder of the ARMs were sampled for all indicator species except sea urchins. Overall, the ARMs are holding up well at this location. New number tags were installed on all 20 ARMs and are listed below.

East group ARMs		**Middle group ARMs**		**West group ARMs**	
old brass	new stainless	old brass	new stainless	old brass	new stainless
33	2351	39	2366	40	2361
38	2352	35	2367	41	2362
188	2353	37	2368	44	2363
31	2354	108 & 36	2369	45	2364
32	2355	43	2370	42	2365

ARMs east of the east end of the transect	
old brass	new stainless
-	2356
-	2357
-	2358
-	2359
-	2360

In the 15 ARMs along the transect: Similar to last year, six *Haliotis corrugata* were found. Their sizes were 21, 31, 34, 36, 44, and 47mm. *Cypraea spadicea* were abundant with an average of 15/ARM. Although small *Hinnites giganteus* have not been particularly abundant in the ARMs at this site, less were found in the modules than the previous three years. Small *Pisaster giganteus* were common. *Strongylocentrotus franciscanus* were abundant with a mean of 58/ARM. *S. purpuratus* were more abundant than the previous several years. This year, the number per ARM was 195, compared to less than half that during the previous three years.

The temperature logger housing and loggers (HOBOTEMP$^{tm.}$ #2410 and STOWAWAY$^{tm.}$ #2910) were missing. The thread rod to which they were attached was slightly bent and a small piece of the housing was still attached to the thread rod between the two bolts. It appears that a strong force such as an anchor broke off the housing. A new housing and HOBOTEMP$^{tm.}$ temperature logger were deployed on July 28, no STOWAWAY$^{tm.}$ logger was available at this time. On September 13, a stowaway temperature logger was deployed to accompany the HOBOTEMP$^{tm.}$. Additional epoxy was placed on the thread rod to reinforce it. Although it is bent, it appears to be strong.

Location: Yellowbanks, Santa Cruz Island

Loran coordinates: 28010.0, 41421.3
Latitude: 33:59.39, Longitude: 119:31.20

We conducted a abalone survey dive on a ledge with a depth of 25-33 meters. Visibility was about 20 meters. This area consisted of a dense *Pelagophycus porra* (elk kelp) forest with and abundance of both large and small plants. Understory algae was abundant consisting of *Eisenia arborea*, *Agarum fimbriatum*, and several species of foliose red algae. Articulated and encrusting algae were abundant. Fish were abundant and diverse near the bottom, but were relatively small.

Live abalone were measured on the bottom. Shells were collected, identified, measured on the surface and thrown overboard. Two large live *Haliotis rufescens* (184 mm, and 214 mm) were found. Five *H. corrugata*,

17 *H. rufescens*, seven *H.* sorenseni (white abalone), and one *H. assimilis* (threaded abalone) shells were found. All of the shells were old except for the *H. assimilis* and one of the *H. rufescens* shells.

Location: Admiral's Reef, Anacapa Island

1995 sampling dates: 8/8, 8/9, 9/14, 9/25

1995 status: Sparse kelp forest/*Strongylocentrotus purpuratus* and *Ophiothrix spiculata* (brittle star) barrens.

This site has changed dramatically since our last visit, especially the southeastern half of the transect. Macroalgae abundance has decreased dramatically. *Macrocystis pyrifera* canopy cover was estimated at 5% and was mostly present over the northwest end of the transect. There were relatively few adult *M. pyrifera* plants along the transect. Juvenile *M. pyrifera* were common on the tops of rocks on the northwest end of the transect. Adult and juvenile *M. pyrifera* densities were at 0.075/m^2 and 0.85/m^2 respectively. This is the lowest density for adult plants recorded at this site. Adult *Eisenia arborea* were common along the transect, but most of the plants appeared old and senescing. Density was the lowest since 1988, 0.25/m^2. *E. arborea* covered 7.7% of the bottom. Juvenile *E. arborea* were present along the northwest half of the transect. *Laminaria farlowii* was rare and only one plant was observed during quadrats. Typically, this site usually has an abundance of *L. farlowii* and the similar brown algae, *Agarum fimbriatum*. No *A. fimbriatum* was observed along the transect this year. *Cystoseira spp.* was rare along the transect and also recorded at its lowest coverage, covering only 0.3% of the bottom. *Cystoseira spp*. is usually abundant along the southeastern half of the transect. Much of the bottom on the last 40 meters (northwest end) of the transect was covered with miscellaneous brown and red foliose algae. A Brown Filamentous alga, possibly diatom chains, was common on this part of the transect and counted as miscellaneous plants on RPCs. Not including coralline algae, algae combined covered 29% of the bottom this year. Algal coverage was 115% in 1994. Please note that there is over 100% cover due to layering of different categories of algae.

On the top of the reef inshore of the transect, macroalgae was abundant and this area appeared similar to previous years. The most abundant algae were *M. pyrifera*, *E. arborea*, *Gelidium purpurescens*, *Gigartina spp.*, and miscellaneous red algae. Both juvenile and small adult *M. pyrifera* plants were abundant here.

The most common miscellaneous invertebrates encountered on RPCs were *Ophiothrix spiculata*, *Spirobranchus spinosus*, hydroids, and gorgonians (mostly *Eugorgia rubens).* Because *Ophiothrix spiculata* were so abundant covering much of the bottom, we counted them separately and then added them to the miscellaneous invertebrate category on RPCs. Miscellaneous invertebrates covered 56% of the bottom, of this 34% were *O. spiculata* and 22% were other miscellaneous invertebrates. This is the highest cover

recorded for miscellaneous invertebrates at this site. Purple gorgonians, *Eugorgia rubens*, were abundant along the transect. *Lophogorgia chilensis*, *Muricea fruticosa*, and *M. californica* were all common.

Strongylocentrotus purpuratus and *Ophiothrix spiculata*, dominated the transect for the first 60 meters (southeast end) of the transect. *S. purpuratus* density was 48/m^2, the highest density recorded at this site. *S. franciscanus* were abundant over the entire transect with a mean density of 9.9/m^2, also their highest recorded density. *S. franciscanus* on the southeastern half of the transect were small and out in the open, while on the north western half of the transect they were larger and mostly confined to crevices. *S. purpuratus* were also larger on this half of the transect. Because of high densities, half square meter quadrats were used to collect *S. franciscanus and S. purpuratus* for size frequencies. Collections were dispersed along the entire transect. *Strongylocentrotus spp.* were actively grazing in fronts along the inshore side of the transect where macroalgae was abundant. *Lytechinus anamesus* were common on the southeastern half of the transect, and were counted on both quadrats (0.45/m^2) and band transects (086/m^2). *Centrostephanus coronatus* (Coronado sea urchins) were common, nine were found during quadrat counts (0.23/m^2). Sea urchin wasting syndrome was common in both *S. purpuratus* and *L. anamesus*. Wasting syndrome appeared to be more prevalent in *S. purpuratus* on our second visit on September 25 than on August 8. *Patiria miniata* and *Parastichopus parvimensis* were common with densities of 0.73/m^2 and 1.7/m^2 respectively. In general, echinoderms were more abundant on the northwestern half of the transect.

Kelletia kelletii were common in small aggregations, however, only one was observed on band transects. *Megathura crenulata* were common. *Hinnites giganteus* were common on the steep inshore/shallow side of the transect, but didn't appear to be as abundant as previous years. Their density (0.044/m^2) was much lower than the previous several years. Furthermore, one would expect the *H. giganteus* to be more visible with the decrease in algal cover this year. *Aplysia californica* were relatively abundant for this site with a density of 0.069/m^2.

Four divers searched the entire transect for *Haliotis corrugata* size frequencies. Chalk was used to mark animals so that they were not remeasured by another diver. The lack of macroalgae, made searching easier than usual at this site. Eight *H. corrugata* were found, all were less than 145mm. *Haliotis spp.* shells were collected, brought to the surface, measured, identified, and then disposed off the site.

In the past fish have been abundant at this site, but this summer, fish were relatively uncommon along the transect. In the shallow areas above the transect where *Macrocystis pyrifera* and other algae were more abundant, fish were moderately abundant. In this area the most common fish were *Oxyjulis californica*, *Chromis punctipinnis*, and *Medialuna californiensis* (half moons) were common. These same fish were rare along the transect.

Four of the ARMs were sampled for all indicator species and three for all indicator species except sea urchins. New stainless steel number tags were attached to the ARMs. The new and old tag numbers are listed below:

Old brass tags	New Stainless steel tags
199	2305
200	2307
176	2308
107	2309
197	2310
198	2306
196	2311

In the ARMs: The number of small *Hinnites giganteus* was much lower than the previous three years, indicating relatively poor recruitment. Only 17 were found in the seven ARMs. *Patiria miniata* were abundant with 60 counted in the seven ARMs. No abalone were found this year. One small (35mm) *Pycnopodia helianthoides* was found. The number of *Strongylocentrotus franciscanus* per ARM was lower than last year, and the mean size was smaller. The average number of *S. franciscanus* was 30/ARM with a mean size of 17mm. The number of *S. purpuratus* per ARM continued its gradual increase since the ARMs were monitored, and this year's mean size was the smallest, indicating recent recruitment. The number per ARM was 195 with a mean size of 10mm. Only one *Centrostephanus coronatus* was found this year.

A new thread rod was installed about one meter from the east end of the transect for the temperature logger. Prior to this, the logger was installed on the east end stake. After 10 days this new thread rod was almost completely covered with filamentous brown algae and the hydroid, *Obelia sp.* Many of the *Obelia sp.* were already about 10mm long with several polyps on each strand.

Location: Cathedral Cove, Anacapa Island

1995 sampling dates: 6/22, 6/23, 7/13, 8/25
1995 status: Kelp forest.

Macrocystis pyrifera canopy cover was estimated at 30%. Adult *M. pyrifera* plants were less abundant than last year. Density this year was 0.15/m^2, and the plants were more abundant on the southeastern half of the transect. Juvenile *M. pyrifera* were abundant with a density of 3.3/m^2. All *M. pyrifera* plants appeared healthy. *Laminaria farlowii* was common with a density of 0.8/m^2. Most (28 of the 32 plants) of the *L. farlowii* counted on quadrats were juveniles. Miscellaneous brown algae covered 10% of the bottom. The brown alga *Dictyota/Pachydictyon* was moderately abundant, and *Colpomenia sp.* was common. The brown

alga *Coilodesme californica* was a common epiphyte on *Cystoseira sp. Cystoseira spp.* covered 6.2% of the bottom. Near the northwest end of the transect where there was less *M. pyrifera*, a small variety of *Ulva sp.*, filamentous brown and red algae were common growing on the cobble. Articulated and encrusting coralline algae covered 23%, and 30% of the bottom respectively. There was less sand than usual along the southeastern end of the transect.

There is a large cobble area inshore at about 30 meters along the transect. Usually, this area has a high density of small adult *Macrocystis pyrifera* plants that are attached to the cobble. It is rare to see large adult *M. pyrifera* plants here. We believe that when these plants get large, their substrate (cobble) is lifted from the bottom and the plants drift away. Except for a few *M. pyrifera* plants on the tops of large boulders there was no *M. pyrifera* observed here this summer. The severe weather conditions experienced earlier this year may have been a factor in removing these *M. pyrifera* plants.

Hydroids (mostly *Aglaophenia sp.*), and worms *Spirobranchus spinosus* and *Pista elongata*, were the most common miscellaneous invertebrates on RPCs. This category covered 20% of the bottom. *Phragmatopoma californica* were common on the southeast end of the transect, though their overall cover was only 1.8%. Bryozoans combined, covered 6.8% of the bottom. Tunicates were abundant and diverse covering 6.6% of the bottom. The most common tunicates were *Aplidium spp.*, *Pycnoclavella stanleyi*, *Didemnum/Tridemnum sp.*, and *Botrylloides sp.*.

Lytechinus anamesus were uncommon and only one was counted on band transects. *Strongylocentrotus franciscanus and S. purpuratus* densities were 6.5/m^2 and 7.3/m^2 respectively. *Patiria miniata* and *Pisaster giganteus* were uncommon along the transect. However, more *P. miniata* were observed than in previous years. *Parastichopus parvimensis* were common with a density of 1.3/m^2.

Panulirus interruptus density was relatively high at 0.0278/m^2. One of the band transects was directly over the "lobster cave" at 32 m along the transect. Nineteen of the 20 *P. interruptus* counted during band transects were on this transect. Large and small *Astraea undosa* were abundant with a density of 2.9/m^2. *Hinnites giganteus* density was recorded at 0.086/m^2. This was the lowest density recorded in five years. *Aplysia californica* were common with a density of 0.024/m^2. Only one *Haliotis corrugata* was found during band transects. This density (0.0014/m^2) was the lowest recorded at this site. Three small (59 mm, 66 mm, and 38 mm) *H. corrugata* shells were found around the transect, indicating some recruitment.

Alloclinus holderi were common with a density of 0.93/m^2. Adult *Chromis punctipinnis* were abundant. Adult *Paralabrax clathratus* and *Girella nigricans* were moderately abundant. *Hypsypops rubicundus* and female *Semicossyphus pulcher* were common.

It appears as if the ARMs were being tossed around during high wave events. Two of the ARMs (#170 and one with no tag) were upside down, and #174 had its sides torn out with most of it's bricks expelled from the cage. Some of these bricks were half buried in the sand. Six ARMs were sampled for all indicator species. The ARMs contained many small (less than 10 cm) *Parastichopus parvimensis*. Several were found that were only several cm long. Small *P. parvimensis* were also common in the natural habitat under rocks. Juvenile *Hinnites giganteus* were abundant in the ARMs as well as in the natural habitat under rocks north of the transect. Juvenile *Strongylocentrotus franciscanus* and *S. purpuratus* were abundant in the ARMs. One live 16 mm *Haliotis corrugata* was found in the ARMs. The ARMs were repaired and turned right side up. New stainless steel number tags were placed on all of the ARMs, and are listed below:

Old brass tags	New Stainless steel tags
175	2348
169	2344
172	2345
170	2347
174	2346
171	2349
173	2350

In the ARMs, only on one 16mm *Haliotis corrugata* was found. The number of *Hinnites giganteus* per ARM was much higher than the past three years and indicated good recruitment at this site in contrast to Admirals Reef. The mean number per ARM was 17. *Patiria miniata* were common in the ARMs, few were present along the transect. The number of *Pisaster giganteus* per ARM was also higher than the past three years. The mean number per ARM was 3.8. *Strongylocentrotus franciscanus* and *S. purpuratus* were abundant with mean number per ARM being 97 and 155 respectively.

Location: Landing Cove, Anacapa Island

1995 sampling dates: 8/7, 8/25, 9/14

1995 status: Sparse kelp forest.

This site appeared similar to previous years. *M. pyrifera* canopy was estimated at 5%, and was mostly present over the shallow/northeastern end of the transect. Adult *M. pyrifera* was scattered along the transect and most abundant on the shallow/eastern end. Juvenile *M. pyrifera* were present along the entire transect. Adult and juvenile densities were 0.53/m^2 and 1.1/m^2 respectively. Understory algae was abundant. *Eisenia arborea* and *Gelidium purpurescens*, were abundant as usual on top of the reef on the shallow/northeastern end of the transect. *E. arborea* density was 1.7/m^2 and covered 17% of the bottom. Of the 69 *E. arborea* counted on quadrats, 13 were juveniles. *Pterygophora californica* were common along the deeper parts of the transect, their density was 0.20/m^2, and no juveniles were observed. *Laminaria*

farlowii was abundant, covering much of the deeper parts of the transect. *L. farlowii* density was 3.5/m^2 and coverage was recorded at 24%. Of the 141 *L. farlowii* plants counted on quadrats, 91 were juveniles. *Cystoseira spp.* was common covering 5.5% of the bottom. Encrusting and articulated coralline algae covered 37% and 20% of the bottom respectively.

The most common miscellaneous invertebrates on RPCs were *Spirobranchus spinosus* and hydroids. This category covered 16% of the bottom. *Aglaophenia latirostris* and *Membranipora sp.* were abundant growing epiphytically on *Gelidium purpurescens*. *Spirobranchus spinosus* were moderately abundant in the deeper areas of the transect. Spirorbids were common on the eastern end of the transect, growing epiphytically on algae. Sponges and tunicates were common covering 2.4% and 3.7% of the bottom respectively. Bryozoans combined covered 15% of the bottom.

Patiria miniata and *Pisaster giganteus* were uncommon along the transect. *Strongylocentrotus franciscanus and S. purpuratus* were common with densities of 2.8/m^2 and 4.0/m^2 respectively. *Parastichopus parvimensis* density was 0.53/m^2.

Hinnites giganteus were abundant along vertical walls near the transect and on the shallow reef. Their density was recorded at 0.63/m^2. *Astraea undosa* were moderately abundant with a density of 2.0/m^2, with both large and small individuals present. *Haliotis corrugata* were common, however only six were counted during band transects (0.0083/m^2). This is the lowest density recorded at this site, but was possible an artifact of sampling. During size frequency measurements, 47 *H. corrugata* were located.

Fish were moderately abundant. There were many large *Paralabrax clathratus* observed on the shallow/eastern end of the transect. Male and female *Semicossyphus pulcher* were moderately abundant. *Hypsypops rubicundus* were common and several nests were present along the transect. *Girella nigricans* (Opaleye), *Chromis punctipinnis*, *Oxyjulis californica*, and *Halichoeres semicinctus* were all common. Bait balls of *Sardinops sagax* (sardines) and *Engraulis mordax* (anchovies) were commonly observed during the summer in the Landing Cove.

We were unable to locate two of the ARMs. Two or three of the five ARMs that were located were upside down. Three ARMs were sampled for all indicator species. One was sampled on August 16 for a Man in The Biosphere workshop, and the other two on September 14. The two remaining ARMs were sampled for all indicator species except sea urchins; these two ARMs were upside down. New number tags were placed on the ARMs and several broken bricks were replaced with new ones.

Old brass tags **New Stainless steel tags**

193	2375
190	2376
179	2371
178	2372
195	2374
missing	-
missing	-

In the ARMs, only one *Haliotis corrugata* was found. The number *of Hinnites giganteus* was lower than the last two years. The mean number per ARM was 3.8. The number of *Patiria miniata* per ARM was 8,2 with a mean size of 20mm. Small *Pisaster giganteus* were common with a 2.6/ARM and a mean size of 31mm. The number of *Strongylocentrotus franciscanus* and *S. purpuratus* per ARM continued to increase. This year the number per ARM was 82, and 333, respectively.

Location: offshore of Admiral's Reef, Anacapa Island

Loran coordinates: 28024.5 41401.5

Sampling date: 9/25

Status: Mature kelp forest/*Ophiothrix spiculata* barrens.

We conducted a abalone survey on the reef directly offshore of the Admiral's Reef transect. The top of the reef is at a depth of 16 meters and rapidly (vertically in some areas) drops to 36 meters on the south side. Adult and juvenile *Macrocystis pyrifera* were common on the top of the reef. *Eisenia arborea* were common at both the shallow and deeper parts of the reef. The most dominant organism was *Ophiothrix spiculata*, and one could describe much of this area as *O. spiculata* barrens. *Centrostephanus coronatus* were relatively abundant. *Lytechinus anamesus* were common at the sand/reef interface of 30 meters. Both large and small *L. anamesus* were common, this is different from the transect inshore, where we rarely observe small *L. anamesus*. Both *Lophogorgia chilensis* and *Eugorgia rubens* were moderately abundant. *Muricea californica* and *M. fruticosa* were common. The parchment tube worms, *Chaetopterus variopedatus*, were moderately abundant creating thick mats. Water temperature was recorded at 56 °F at a depth of 35 meters, and at 65 F at 20 meters, with a strong thermocline at about 27 meters.

Five divers surveyed for abalone finding only six live *Haliotis corrugata* (119, 122, 128, 130, 145, and 147 mm). Abalone shells were collected, but only as many as divers could carry. Shells were brought to the surface, measured, and then disposed off the site. A total of 72 *Haliotis corrugata* shells ranging in size from 69 - 199 mm, five white abalone shells ranging in size from 142 - 156 mm, and two unidentified shells were collected. All of the shells were old except for two fresh *Haliotis corrugata* shells (121, 133 mm).

Location: Survey Rock, Anacapa Island

Sampling date: 9/29

Status: *Strongylocentrotus purpuratus* barrens.

We conducted a *Stereolepis gigas* (giant black sea bass) survey offshore of Survey Rock at a depth of 16 meters. All eight divers observed *S. gigas* at this location. Up to eight were observed at one time. One fish with a deformed head was observed, this fish has been previously reported here by other divers. We observed black sea bass on both of the dives that were conducted. It appears that the sea bass were actually curious about the divers, as they would make repeated passes by a stationary diver. If a diver attempted to get too close to one of the fish they would slowly swim away. All of the fish observed had some degree of spotting in their coloration,and were of large size.

Location: Southeast Sea Lion, Santa Barbara Island

1995 sampling dates: 7/10, 7/11, 9/11

1995 status: *Strongylocentrotus purpuratus* barrens.

This site has changed dramatically since last year. *Strongylocentrotus purpuratus* dominates the site and macroalgae was virtually absent. Only one juvenile *Macrocystis pyrifera* and one small *Cystoseira sp.* were present along the transect. Both of these were growing epiphytically on gorgonians. The green algae, *Halocystis ovalis*, was common on the tops of large rocks. Algae (not including the corallines) covered only covered 2.0% of the bottom, and most of this was filamentous red algae. Articulated coralline algae covered 0.4% of the bottom, and much of this algae was being grazed by sea urchins. Encrusting coralline algae was abundant covering 58% of the bottom. Bare substrate covered 21% of the bottom.

Miscellaneous invertebrates on RPCs covered 9.8% of the bottom and consisted mostly of hydroids, anemones, and *Spirobranchus spinosus*. *Balanophyllia elegans and Astrangia lajollaensis* covered 3.0% and 6.0% of the bottom respectively. Bryozoans and tunicates were well below their 14 year means for this site. Their coverage were 0.3% and 0.9% respectively. *Lophogorgia chilensis*, and *Muricea californica* were common, while *M. fruticosa* were less common along the transect. Their densities were 0.11/m^2, 0.026/m^2 and 0.0028/m^2 respectively. *Tethya aurantia* were abundant with a density of 0.13/m^2.

Strongylocentrotus purpuratus carpeted the bottom with a density of 108/m^2. This is the highest recorded density for this site and a increase from 65/m^2 in 1994. *Strongylocentrotus franciscanus* density was 4.6/m^2. Very small < 10 mm *S. purpuratus* were abundant on the encrusting coralline algae. These small

sea urchins were covered with sand and/or debris and were probably not counted on quadrats because they were too difficult to see. One meter square quadrats were used to collect *S. franciscanus and S. purpuratus* for size frequency measurements. Not many red urchins were collected in the quadrats, so additional ones were measured using the band transect search method. Five 1-m^2 quadrats were sampled for sea urchins. The mean density in these quadrats for *S. franciscanus and S. purpuratus* were 6.8/m^2 and 211/m^2 respectively. *Lytechinus anamesus* were common and were counted on both band transects and quadrats. Their respective densities were 0.62/m^2 and 2.0/m^2. In general, sea urchins were out in the open and not confined to crevices. *Patiria miniata* and *Pisaster giganteus* were common. *Parastichopus parvimensis* were common with a density of 1.2/m^2.

Sea urchin wasting syndrome was observed in *S. purpuratus*, *S. franciscanus*, and *L. anamesus*. We estimated that 50% of the *S. purpuratus* and *S. franciscanus* had signs of wasting syndrome. Only several *L. anamesus* were observed with wasting syndrome. Most of the *S. franciscanus* with wasting syndrome appeared close to death (almost devoid of spines, and moving slowly), while only about 10% of the *S. purpuratus* appeared this way. Whole sea urchin tests were common on the bottom, indicating recent mortality. Tests appeared more abundant on September 11, than on July 11.

Megathura crenulata were relatively common for this site with a density of 0.015/m^2. *Aplysia californica* were common with a density of 0.035/m^2. No *Haliotis spp.* were found on band transects this year. *Astraea undosa* were common with a density of 0.63/m^2. One coffee bean snail, *Trivia solandri*, was observed. These appeared much less abundant than last year when many were observed. Abalone shells were collected, measured, and disposed of off the transect.

Coryphopterus nicholsii and *Alloclinus holderi* were common with densities of 0.73/m^2, and 0.58/m^2 respectively. Female *Semicossyphus pulcher*, adult *Chromis punctipinnis*, male and female *Halichoeres semicinctus*, adult and juvenile *Hypsypops rubicundus*, and *Paralabrax clathratus* were all common.

On July 10, a commercial fish trapper was working about 200 m from the transect. The trapper had set many traps in the area and we watched the trapper bring up the two that were closest to the transect. These traps had “large numbers” of fish estimated at 10-20/trap that appeared to be mostly female *Semicossyphus pulcher*. Please note that these observations were made using binoculars, so that a positive identification of the numbers and species of fish could not be made.

A new thread rod was installed about one meter west of the north end of the transect for the temperature logger (currently the temperature logger is attached to the same thread rod as the transect lead-line. Unfortunately the thread rod was one of the longer pieces and sticks out about 35 cm above the substrate,

hopefully this will be satisfactory. Since we installed this thread rod during our last visit, the logger will be transferred to its new thread rod next year.

Location: Arch Point, Santa Barbara Island

1995 sampling dates: 7/11, 7/12, 9/12

1995 status: *Strongylocentrotus purpuratus* barrens.

This site has changed drastically, similarly to Southeast Sea Lion. *Strongylocentrotus purpuratus* dominates the site and macroalgae was virtually absent. One juvenile *Macrocystis pyrifera* plant was observed on top of a large rock next to the transect. Three adult *M. pyrifera* plants were about 5-10 meters off the transect, and a small patch of about 10 adult plants were present about 15 meters west of the south end of the transect. Most of these kelp plants had large numbers of *S. purpuratus* around their holdfast. With such high densities of *S. purpuratus* we don't expect these plants to survive. No juvenile *M. pyrifera* were observed. One adult and one juvenile *Eisenia arborea* were observed about seven meters east of the south end of the transect. Several patches of the brown algae, *Dictyota/Pachydictyon,* and several clumps of the green algae, *Codium sp.*, were present on the tops of rocks. Some *Gelidium purpurescens* was present near the *Hypsypops rubicundus* nests along the transect. Miscellaneous red algae covered 12% of the bottom, much of this was filamentous red algae. Other than corallines, this is the only algae recorded on quadrats and RPCs. Several *Laminaria farlowii* plants were growing on a rock surrounded by sand, east of the transect. Articulated coralline algae decreased in coverage to 1.4% (down from 30% in 1994), and was observed being grazed by sea urchins. This is the lowest coverage recorded for this algae at this site. Encrusting coralline algae covered 58% of the substrate, and 22% of the bottom was bare substrate.

The most common miscellaneous invertebrates on RPCs were an unidentified anemone, *Spirobranchus spinosus*, and hydroids. The unidentified anemones were found in small aggregations about 2-3 cm long, 1 cm wide, beige in color and covered with fine sand. This category covered 6.9% of the bottom. *Corynactis californica* and *Astrangia lajollaensis* covered 3.7% and 2.2% of the bottom respectively. Bryozoan coverage decreased and were uncommon covering only 0.7% of the bottom (in 1994 their coverage was 25%). Tunicates and sponges were uncommon covering 0.1% and 0.0% of the bottom respectively.

Patiria miniata and *Pisaster giganteus* were rare. A good search effort was made for size frequencies and only five *P. miniata* and 12 *P. giganteus* were found. *Strongylocentrotus franciscanus* were abundant with a density of 11/m^2. This is the highest density recorded at this site. *S. purpuratus* were abundant with a density 134/m^2, which is the highest density recorded since 1986. Very small (less than 10 mm) *S. purpuratus* were abundant on the encrusting coralline algae. These small sea urchins were covered with

sand or debris and were probably not counted on quadrats because they were too difficult to see. *Lytechinus anamesus* were uncommon with a density of 0.011/m^2. In general, sea urchins were out in the open and not confined to crevices. On July 12 there were no *S. purpuratus* or *L. anamesus* observed with wasting syndrome. Wasting syndrome was common in *S. franciscanus*, but was not as prevalent as at Southeast Sea Lion. On September 12, we observed both *S. purpuratus* and *S. franciscanus* with wasting syndrome.

S. purpuratus for size frequencies were located using 1m^2 quadrats. Only two quadrats were used to sample the urchins, one contained 468 and the other 490 *S. purpuratus*. *S. franciscanus* were also collected in the two quadrats, but an additional band transect search was used to acquire an adequate sample size.

Astraea undosa were abundant with a density of 3.8/m^2. *Aplysia californica* and *Hinnites giganteus* were common with densities of 0.068/m^2 and 0.038/m^2 respectively. Turban snails, *Tegula sp.*, were common along the transect. Octopus were also common along the transect. One small (22 mm) black abalone shell was found near the transect. The shell appeared relatively fresh, and may have died in the past year, indicating recent recruitment.

Adult and juvenile *Hypsypops rubicundus* were abundant, and several nests were present along the transect. Two tagged *H. rubicundus* were observed. Female *Semicossyphus pulcher* were moderately abundant and were observed feeding on sea urchins, one male was also observed. Adult *Oxyjulis californica* were common as were juveniles in small schools. *Girella nigricans* and *Medialuna californiensis* (halfmoons) were abundant along the transect. *Alloclinus holderi* were abundant, but most were small. Their density was recorded at 1.4/m^2, the highest density recorded for this site.

Location: Cat Canyon, Santa Barbara Island

1995 sampling dates: 7/12, 7/13, 9/12
1995 status: Kelp forest.

Macrocystis pyrifera canopy cover was estimated at 65% over the transect. Juvenile, large and small adult *M. pyrifera* plants were abundant along the transect. All of the plants appeared healthy. Adult and juvenile densities were 1.4/m^2, and 5.4/m^2 respectively, and coverage was recorded at 57%. Miscellaneous brown algae covered 27% of the bottom, and consisted almost exclusively of *Pachydictyon/Dictyota*. This was the highest coverage recorded for this category at this site since monitoring began. *Cystoseira spp.* was common covering 6.0% of the bottom. Miscellaneous red algae covered 14% of the bottom. Articulated

corallines were abundant and diverse on the tops of rocks, covering 27% of the bottom. Encrusting coralline algae covered 31% of the bottom, and bare substrate was relatively uncommon, covering 5.2%. Although macroalgae was relatively abundant along the transect, there were small areas that were devoid of algae with high densities of *Strongylocentrotus spp.* near the transect.

Miscellaneous invertebrates on RPCs covered 17% of the bottom. This category consisted mostly of *Spirobranchus spinosus*, hydroids, and amphipod tube mats. *Phragmatopoma californica* were abundant covering 15% of the bottom. Bryozoans combined covered 5.1% of the bottom. Tunicates were common covering 4.7%, but were notably less abundant than last years 21% coverage.

Patiria miniata were rare, and none were observed on quadrats. *Pisaster giganteus* were common, but only three were counted on quadrats. Sixty eight were found for size frequencies. *Strongylocentrotus purpuratus* density increased from last year, this years density was 14/m^2. *Strongylocentrotus franciscanus* density increased dramatically to 11/m^2. This is considerably above the ten year mean for this site (3.4/m^2). Most of the *S. franciscanus and S. purpuratus* were out in the open, not confined to crevices. Small patches of sea urchin barrens consisting mostly of *S. franciscanus* were present about 15 meters south of the east end of the transect. Juvenile *S. purpuratus* and *S. franciscanus* were uncommon under the spine canopies of adults. No sea urchin wasting syndrome was observed.

Astraea undosa were common with a density of 0.58/m^2. Turban snails, *Tegula sp.*, were abundant along the transect. Only one *Haliotis corrugata* was found during band transects. Two *H. corrugata* were found for size frequencies during the July visit, and three more were found during the September visit. In September, six divers using chalk to mark measured abalone, conducted the search. Two small (41 mm, and 44 mm) fresh and two old (159 mm, and 84 mm) *H. corrugata* shells, and one very old (138 mm) *Haliotis fulgens* shell were found. *Haliotis spp.* shells were collected, measured and then disposed of off the site. *Hinnites giganteus* and *Kelletia kelletii* were rare along the transect. *Megathura crenulata* were common, seven were counted on band transects (0.0097/m^2). Two *Panulirus interruptus* were observed on band transects.

Fish were relatively abundant at this site. Juvenile *Oxyjulis californica* were abundant in schools along the entire transect. Male and female *Halichoeres semicinctus* were also abundant. Adult *O. californica*, adult *Chromis punctipinnis*, juvenile *Heterostichus rostratus*, *Paralabrax clathratus*, and *Brachyistius frenatus* were all common. Several *Embiotoca jacksoni* and *Medialuna californiensis* (halfmoons) were observed. *Myliobatis californica* were abundant, especially at the east end of the transect. *Coryphopterus nicholsii* were uncommon, only two were observed on quadrats. *Alloclinus holderi* density was 0.88/m^2.

An old (probably from last year) lobster trap was found just a few meters from the line. The door to the trap was still closed, latched by home-made elastic cords. No organisms were trapped inside, and we opened the door.

Location: Underwater plateau east/northeast of Arch Point, Santa Barbara Island

1995 sampling date: 9/12

1995 status: Mature kelp forest/*Ophiothrix spiculata* barrens.

Loran coordinates: 28068.3 : 41179.8

Latitude: 33:29.17 N

Longitude: 110:01.11 W

We conducted a brief survey dive to search for *Haliotis sorenseni* (white abalone). This location is a small underwater plateau that rises to about 22 meters from a depth of about 40 meters. This area was typical of a mature kelp forest with large, widely spaced *Macrocystis pyrifera* plants. Because of a moderate current we were unable to estimate canopy cover. Understory algae consisted mostly of *Pterygophora californica* and *Eisenia arborea*, and some *Laminaria farlowii*. The most notable invertebrate was the brittle star, *Ophiothrix spiculata*, which covered much of the bottom. *Tethya aurantia*, and *Lophogorgia chilensis* were also notably abundant. Five *Stereolepis gigas* (giant black sea bass) were observed. Three had juvenile coloration and two large adults estimated at 2 meters in length.

Abalone shells were collected and brought to the surface for measuring and identification. Because of the large number of abalone shells on the bottom, divers were only able to bring up a fraction of the shells that were seen. A total of 73 *Haliotis corrugata* and six *H. sorenseni* shells were found. Only two live abalone were found, both were *H. corrugata*.

GENERAL DISCUSSION

In 1995, *Macrocystis pyrifera* (giant kelp) forests were present at eight of the 16 sites. These sites included Cat Canyon at Santa Barbara Island, Cathedral Cove and Landing Cove at Anacapa Island, Gull Island South and Yellowbanks at Santa Cruz Island, Johnson's Lee North and Johnson's Lee South at Santa Rosa Island, and Wyckoff Ledge at San Miguel Island. Seven of the sites were dominated by echinoderms. Arch Point and Southeast Sea Lion Rookery, Santa Barbara Island, and Pelican Bay and Scorpion Anchorage, Santa Cruz Island were dominated by *Strongylocentrotus purpuratus* (purple sea urchins). Hare Rock, San Miguel Island was dominated by *Strongylocentrotus franciscanus* (red sea urchins). Admiral's Reef, Anacapa Island was dominated by both *S. purpuratus* and *Ophiothrix spiculata* (brittle stars), however some

M. pyrifera was present along the west end of the transect. Fry's Harbor, Santa Cruz Island was dominated by *Pachythyone rubra*. Rodes Reef, Santa Rosa Island was an open area with a moderate abundance of red algae and *S. franciscanus*.

The increase in sea urchin densities at Santa Barbara Island we observed in 1994 continued this year. It appears that the large numbers of small sea urchins we observed in 1994 appeared to have matured and have caused wide spread sea urchin barrens on much of the Island. All three monitoring sites were kelp forests in 1994, while this year only one site (Cat Canyon) had a substantial amount of *Macrocystis pyrifera*. Sea urchin densities at Cat Canyon appear to be increasing and there were patches of sea urchin barrens close to the transect. Overall, these three sites appear to be a good representation of the overall situation on Santa Barbara Island. This summer there was very little *Macrocystis pyrifera* canopy cover around the island compared to 1994, and high densities of sea urchins were reported from around the island.

The sea urchin wasting syndrome that was first observed during kelp forest monitoring in 1992 (Richards and Kushner, 1994) was observed at five sites this year, compared to six in 1992, and seven in 1993 and 1994. This year it was observed in *Strongylocentrotus purpuratus* at Gull Islands South and Fry's Harbor at Santa Cruz Island, *S. purpuratus* and *Lytechinus anamesus* at Admirals reef Anacapa Island, *S. purpuratus*, *S. franciscanus*, and *L. anamesus* at Southeast Sea Lion Rookery, and *S purpuratus* and *S. franciscanus* at Arch Point on Santa Barbara Island. The two sites on Santa Barbara Island appeared to have the highest prevalence of this syndrome. We have attributed past high mortality of sea urchins to this syndrome in the past (Kushner et al. 1995).

Sea star wasting disease was not observed in 1995 (Table 6). This disease, in which the diseased animals appear to be decaying, is possibly caused by a bacterial infection (Schroeter and Dixon, 1988). Observations of this disease have gradually decreased since 1992. The disease was observed at eight sites in 1992, three sites in 1993, and one site in 1994.

It appears that 1995 may have been a good recruitment year for *Parastichopus parvimensis*. Without specifically searching for them, we often noticed small *P. parvimensis* at all of the sites around Santa Barbara Island and in some places at Anacapa Island. Many less than 50mm were found under small rocks.

Southern California experienced above average rainfall for 1995. During Spring of 1995 there were several major storm events that caused flooding on the mainland and washed out many of the roads on Santa Cruz and Santa Rosa Island. Parts of Santa Cruz and most of Santa Rosa Island are heavily grazed, and this type of land use has been recognized to increase surface runoff and increase soil erosion (Cooperrider &

Hendricks 1937). This, in conjunction with the large storms, caused significant runoff and siltation of the immediate coastal areas around the larger Channel Islands. Although we do not monitor sedimentation as part of the kelp forest monitoring program, we did notice abnormally large amounts of silt at some of our sites. Both of the Johnson's Lee sites, Santa Rosa Island, and Yellowbanks, Santa Cruz Island appeared to have higher than normal amounts of sediment/silt. In some cases it was difficult to identify or count certain species such as *Tethya aurantia* because of the sediment.

Winter storms caused some considerable damage to the artificial recruitment modules at several of the sites in 1995. The damaged modules were repaired, however replacements are needed. Several of the ARMs were relocated short distances to areas (closer to large rocks) we felt will be better protected from surge. The ARMs appear to be proving useful as a tool to measure recruitment. For several species such as *Strongylocentrotus spp*. we are beginning to follow size class cohorts at some of the sites. Overall, there were fewer first year recruits (<15mm) of *Strongylocentrotus spp.* than last year. The number of *Hinnites giganteus* present in the ARMs declined to about half of the #/ARM found in 1994, indicating less recruitment or higher mortality in 1995. Approximately the same number of *Haliotis rufescens* and about half the number of *H. corrugata* were found in the ARMs as in 1994. The number of *Strongylocentrotus spp*. per ARM appears to have leveled off. The number per ARM have gradually increased since the ARMs were installed. This may have been due to recruitment or simply the process of colonization in the ARMs? Future years of data will give insight to questions such as these and begin to give us a baseline of recruitment information.

Sea surface temperatures were as much as 3°F above normal (NOAA, 1995). These temperatures were closer to normal than in 1994. We didn't notice any unusual warm water species this year. We did observe *Cypselurus californicus* (California flying fish) between SRI and SCI during the first cruise in June. This is towards the northern most range for this fish.

We gathered temperature data from all sites with the exception of SCI Yellowbanks, where the temperature loggers were missing. The other 15 Stowaway temperature loggers retrieved, worked without incidence. However, several of the Hobotemp loggers that accompanied the Stowaways as backups failed.

Since the remote temperature loggers have been deployed at all of the monitoring sites we have experienced several instances which have led us to believe the housings have been physically removed by a diver. We believe no harm was intended, but that the units were removed out of curiosity. This year we fastened stainless steel dog tags stating "PLEASE DO NOT DISTURB TEMPERATURE RECORDING DEVICE NATIONAL PARK SERVICE INFO 805-658-5773" to the outside of the housings. We are hoping this will satisfy a divers curiosity if they happen upon one of the units.

All monitoring was completed this year except for one fish transect at Rodes Reef, Santa Rosa Island. This was not completed due to unsafe diving conditions during our second visit to the site. Transect lead line repair was completed as necessary at all locations, but several locations are in need of new eye bolts to hold the lead line in place. ARMs were repaired as needed at several of the sites, however several ARMs were missing and not replaced due to limited supplies and time.

This year we began our transition from DbaseIII to Microsoft Access. This has been painstaking but we feel in the long-term it will benefit the data management aspect of this program. Changes in data management and entry procedures will be described in a new Kelp Forest Monitoring Handbook that is in progress.

There has been a significant increase in the number of fish trappers working the Islands. Fish trappers use lobster type traps and were observed mostly trapping fish around Santa Barbara and Anacapa Islands. Several fish traps were observed being pulled at Santa Barbara Island. It appeared that there were as many 10 - 20 fish, mostly consisting of *Semicossyphus pulcher*, in the traps. Impacts of this fishery are unknown.

In September, 1995 the Kelp Forest Monitoring Design Review Workshop was held. This workshop was the next step in analyzing the results of a temporal trends analysis of the 1982 through 1993 kelp forest monitoring data that was conducted by the firm Ecometrics in 1994. The workshop was attended by biologists, statisticians, and managers experienced in long-term ecological studies and coastal ecosystem monitoring. The participants were asked to evaluate the analysis and to apply their expertise to improving the program. The results of this workshop were published in “Kelp Forest Monitoring Design Review” (Davis et al. 1996).

We had several requests for Kelp Forest Monitoring data in 1995. Fish data was sent to Dr. Ralph Larson and Scott Clark at San Francisco State University. All of the Kelp Forest Monitoring Data was sent to Dr. Mia Tegner at the Scripps Institution of Oceanography. Project divers assisted the California Department of Fish and Game with abalone and sea urchin surveys on the Channel Islands.

ACKNOWLEDGEMENTS

This ecological monitoring program was supported by the U.S. National Park Service in cooperation with the California Department of Fish and Game and the U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, Marine Sanctuary Program.

We are deeply indebted to the many divers who have participated in this endeavor. In particular were the sustained efforts of Derek Lerma, Jeffrey Mondragon, Jennifer Morgan, and Michael Pentony who worked on the project collecting and processing data. Dan Richards and Gary E. Davis continued to provide advice and support for the project as well as participating in data collection. We are indebted to Valerie Bryson, our computer consultant for her expertise and patience in converting our database to Access. We also appreciate the efforts of Diane Richardson, John Provo, Tom Dore, and Dave Stoltz for supporting us on the boats and keeping us afloat and underwater.

We would like to acknowledge Lt. Cmdr. John Miller and the Channel Islands Marine Sanctuary for their support and funds that were provided to conduct the Kelp Forest Monitoring Review Workshop. We would also like to thank all who participated in this workshop. Also, a thanks to the outside reviewer who made some valuable comments about this report.

LITERATURE CITED

Abbott I. A., and G. J. Hollenberg. 1976. Marine Algae of California.

Cooperrider, C. K., and B. A. Hendricks. 1937. Soil erosion and streamflow on range and forest lands of the upper Rio Grande watershed in relation to land resources and human welfare. Technical Bulletin 567. U.S. Department of Agriculture, Washington, D.C.

Davies, D. H. 1968. Statistical analysis of the relation between kelp harvesting and sportfishing in the California kelp beds. In North, W. J. and Hubbs, C. L. (editors) Utilization of Kelp-bed Resources in Southern California. pp. 151-212. Calif. Dept. of Fish and Game Fish Bull. 139.

Davis, G. E. 1985. Kelp forest monitoring program: preliminary report on biological sampling design. Univ. of Cal. Davis Coop. National Park Resources Studies Unit. Tech. Rept. No. 19. 46p.

Davis, G. E. 1986. Kelp forest dynamics in Channel Islands National Park, California, 1982-85. Channel Islands National Park and National Marine Sanctuary Natural Science Study Reports. CHIS-86-001. 11p.

Davis, G. E. 1988. Kelp forest monitoring handbook for Channel Islands National Park, California. Channel Islands National Park Natural Science Reports. Ventura, California. 34 pp.

Davis, G. E. and W. L. Halvorson. 1988. Inventory and monitoring of natural resources in Channel Islands National Park California. Channel Islands National Park Natural Science Reports. Ventura, California.

Davis, G. E., D. V. Richards and D. J. Kushner. 1996. Kelp Forest Monitoring Design Review. Technical Report CHIS-96-01.

Engle, J. M. (Personal Communication) Tatman Foundation. Santa Barbara, CA.

Eschmeyer, W. N., E. S. Herald, and H. Hammann. 1983. A Field Guide to Pacific Coast Fishes.

Kushner, D., R. Walder, L. Gorodezky, D. Lerma, D. V. Richards. 1995. Kelp forest ecological monitoring Channel Islands National Park (1993 annual report). Technical Report CHIS-95-02.

Kushner, D. J., D.L. Lerma, D. V. Richards. 1995. Kelp Forest Monitoring, 1994 Annual Report. Technical Report CHIS-95-03.

Morris, R. H., D. P. Abbott, and E. C. Haderlie. 1980. Intertidal Invertebrates of California.

National Oceanographic and Atmospheric Administration, Coastal Ocean Program. 1995. El Niño Watch, Advisory no. 95-1 through 95-12.

Richards, D. V., C. Gramlich, G. E. Davis. In prep. Kelp forest ecological monitoring Channel Islands National Park 1982 - 1989.

Richards, D.V., W. Avery and D. Kushner. 1993. Kelp Forest Monitoring -- Channel Islands National Park (1990 annual report). Technical Report NPS/WRUC/NRTR-93/05.

Richards, D.V., D. Kushner and W. Avery. 1993. Kelp Forest Monitoring -- Channel Islands National Park (1991 annual report). Technical Report NPS/WRUC/NRTR-93/06.

Richards, D.V. and D. Kushner. 1994. Kelp Forest Monitoring, 1992 annual report. Channel Islands National Park, Ventura, California. Technical Report CHIS-94-01

Schroeter, S. and M. Dixon. 1988. The roll of disease in Southern California kelp forests. Abstracts from the Southern California Academy of Sciences annual meeting. #18.

Woodhouse, C. D. (Principle Investigator). 1981. Literature review of the resources of Santa Cruz and Santa Rosa Islands and the marine waters of Channel Islands National Park, California. Santa Barbara Museum of Natural History Contract Rep. Nat. Park Serv. CX 8000-0-0028. 2 Vol.

Table 1. Regularly monitored species by taxonomic grouping, common name, scientific name and associated monitoring technique.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
ALGAE		
Miscellaneous Green Algae		R
Miscellaneous Red Algae		R
Articulated Coralline Algae		R
Encrusting Coralline Algae		R
Agar weed	*Gelidium spp.*	R
Sea tongue	*Gigartina spp.*	R
Miscellaneous Brown Algae		R
Acid weed	*Desmarestia spp.*	R
Oar weed	*Laminaria farlowii*	R,Q
Bladder chain kelp	*Cystoseira spp.*	R
Giant kelp	*Macrocystis pyrifera*	R,Q
California sea palm	*Pterygophora californica*	R,Q
Southern sea palm	*Eisenia arborea*	R,Q
Miscellaneous plants		R
INVERTEBRATES		
Miscellaneous Sponges		R
Orange puffball sponge	*Tethya aurantia*	B,S
Southern staghorn bryozoan	*Diaperoecia californica*	R
Miscellaneous Bryozoans		R
California hydrocoral	*Allopora californica*	B,S
White-spotted rose anemone	*Tealia lofotensis*	B
Red gorgonian	*Lophogorgia chilensis*	B,S
Brown gorgonian	*Muricea fruticosa*	B,S
California golden gorgonian	*Muricea californica*	B,S
Strawberry anemone	*Corynactis californica*	R
Orange cup coral	*Balanophyllia elegans*	R
La Jolla cup coral	*Astrangia lajollaensis*	R
Hydroids		R
Ornate tube worm	*Diopatra ornata*	R
Colonial sand-tube worm	*Phragmatopoma californica*	R
Scaled-tube snail	*Serpulorbis squamigerus*	R
Chestnut cowrie	*Cypraea spadicea*	Q
Wavy turban snail	*Astraea undosa*	Q,S
Red turban snail	*Astraea gibberosa*	Q,S
Bat star	*Patiria miniata*	Q,S
Giant-spined sea star	*Pisaster giganteus*	Q,S
Sunflower star	*Pycnopodia helianthoides*	B,S
White sea urchin	*Lytechinus anamesus*	B,S
Red sea urchin	*Strongylocentrotus franciscanus*	Q,S
Purple sea urchin	*Strongylocentrotus purpuratus*	Q,S
Warty sea cucumber	*Parastichopus parvimensis*	Q
Aggregated red sea cucumber	*Pachythyone rubra*	R
Red abalone	*Haliotis rufescens*	B,S
Pink abalone	*Haliotis corrugata*	B,S
Green abalone	*Haliotis fulgens*	B,S

Table 1. Continued.

TAXA/COMMON NAME	SCIENTIFIC NAME	TECHNIQUE
Kellet's whelk	*Kelletia kelletii*	B,S
Giant keyhole limpet	*Megathura crenulata*	B,S
California brown sea hare	*Aplysia californica*	B
Rock scallop	*Hinnites giganteus*	B,S
California spiny lobster	*Panulirus interruptus*	B
Tunicates		R
Stalked tunicate	*Styela montereyensis*	Q
Miscellaneous Invertebrates		R
FISH		
Bluebanded goby	*Lythrypnus dalli*	Q
Blackeye goby	*Coryphopterus nicholsii*	Q
Island kelpfish	*Alloclinus holderi*	Q
Blacksmith	*Chromis punctipinnis*	V
Señorita	*Oxyjulis californica*	V
Blue rockfish	*Sebastes mystinus*	V
Olive rockfish	*Sebastes serranoides*	V
Kelp rockfish	*Sebastes atrovirens*	V
Kelp bass	*Paralabrax clathratus*	V
California sheephead	*Semicossyphus pulcher*	V
Black surfperch	*Embiotoca jacksoni*	V
Striped surfperch	*Embiotoca lateralis*	V
Pile perch	*Damalichthys vacca*	V
Garibaldi	*Hypsypops rubicundus*	V
Opaleye	*Girella nigricans*	V
Rock Wrasse	*Halichoeres semicinctus*	V
SUBSTRATE		
Bare substrate		R
Substrates: Rock		R
Cobble		R
Sand		R

B= Band Transect
Q= Quadrat
R= Random Point Contact
S= Size frequency Measurement
V= Visual Transect

CHANGES IN SCIENTIFIC NOMENCLATURE:

Patiria miniata	=	*Asterina miniata*
Astraea undosa	=	*Lithopoma undosum*
Astraea gibberosa	=	*Lithopoma gibberosum*
Hinnites giganteus	=	*Crassedoma giganteum*

Table 2. Station Information.

ISLAND	LOCATION	ABBREVIATION	DEPTH METERS	YEAR ESTABLISED
San Miguel	Wyckoff Ledge	SMWL	13-15	1981
San Miguel	Hare Rock	SMHR	6-9	1981
Santa Rosa	Johnson's Lee North	SRJLNO	9-11	1981
Santa Rosa	Johnson's Lee South	SRJLSO	14-16	1981
Santa Rosa	Rodes Reef	SRRR	13-15	1983
Santa Cruz	Gull Island South	SCGI	14-16	1981
Santa Cruz	Fry's Harbor	SCFH	12-13	1981
Santa Cruz	Pelican Bay	SCPB	6-8	1981
Santa Cruz	Scorpion Anchorage	SCSA	5-6	1981
Santa Cruz	Yellowbanks	SCYB	14-15	1986
Anacapa	Admiral's Reef	ANAR	13-15	1981
Anacapa	Cathedral Cove	ANCC	6-11	1981
Anacapa	Landing Cove	ANLC	5-12	1981
Santa Barbara	Southeast Sea Lion Rookery	SBSESL	12-14	1981
Santa Barbara	Arch Point	SBAR	7-8	1981
Santa Barbara	Cat Canyon	SBCAT	7-9	1986

Table 3. Summary of sampling techniques used to monitor population dynamics of selected kelp forest organisms.

TECHNIQUE	SAMPLE NUMBER OF SIZE REPLECATES
Quadrat count	1 m X 1 m 40X / site
Band Transect count	3 m X 10 m 24X / site
Random Point Contact	40 points 25X / site (0.5 x 3 m)
Visual Fish transects	2 m(w) X 3 m(h) X 100 m(l) 8X / sites 5 minutes
Video transects	5 minutes / 100 m; 2X / site
Size frequency measurements	30 to 200 / species: 1X / site (see size frequency measurement dimensions below)
Species Checklist	30 - 90 minutes, 1X / site
Artificial Recruitment Modules	7 - 15 modules / site

Size Frequency measurement dimensions:

Genus	Sample Size	Measurement
Macrocystis	100	Stipe count (1 m above bottom), max. holdfast diameter, mm
Tethya	30	Max. diameter, mm
Allopora	50	Max. height and width, mm
Lophogorgia	30	Max. height and width, mm
Muricea	30	Max. height and width, mm
Megathura	30	Max. shell length, mm
Haliotis	30	Max. shell length, mm
Astraea	30	Max. shell diameter, mm
Kelletia	30	Max. shell length, mm
Hinnites	30	Max. shell length, mm
Strongylocentrotus	200	Max. test diameter, mm
Lytechinus	200	Max. test diameter, mm
Pycnopodia	30	Length of the longest ray, mm
Patiria	30	Length of the longest ray, mm
Pisaster	30	Length of the longest ray, mm

Table 4. Kelp forest monitoring site status 1995.

ISLAND/SITE	STATUS
San Miguel Island:	
Wyckoff Ledge	Mature kelp forest with a dense understory of red and brown algae.
Hare Rock	Sea urchin barrens, high density of Strongylocentrotus franciscanus.
Santa Rosa Island:	
Johnson's Lee North	Mature kelp forest.
Johnson's Lee South	Mature kelp forest with a dense understory of red algae.
Rodes Reef	Open area with a moderate abundance of understory red algae and Strongylocentrotus franciscanus.
Santa Cruz Island:	
Gull Island South	Sparse kelp forest.
Fry's Harbor	Open area with an abundance of Pachythyone rubra and Astrangia lajollaensis.
Pelican Bay	Sea urchin barrens with a high density of Strongylocentrotus purpuratus.
Scorpion Anchorage	Sea urchin barrens with a high density of Strongylocentrotus purpuratus.
Yellowbanks	Mature kelp forest.
Anacapa Island:	
Admiral's Reef	Strongylocentrotus purpuratus and Ophiothrix spiculata barrens, with a sparse kelp forest on the west end of the transect.
Cathedral Cove	Kelp forest.
Landing Cove	Open kelp forest.
Santa Barbara Island:	
Southeast Sea Lion Rookery	Sea urchin barrens with a high density of Strongylocentrotus purpuratus.
Arch Point	Sea urchin barrens with a high density of Strongylocentrotus purpuratus.
Cat Canyon	Kelp forest.

Table 5. 1995 Kelp Forest Monitoring Program participant and cruise list.

PARTICIPANTS	AFFILIATION	CRUISES PARTICIPATED
Arnold Ammann	University of Calif. Santa Barbara	6
Kenneth Baltz	NOAA	6
John Brooks	NPS Submerged Cultural Resources Unit	7
Dr. Colin Buxton	Rhodes University	7
Don Canestro	University of Calif. Santa Cruz	7
John Conti	Channel Islands National Park VIP	5
Karen Crow	Moss Landing Marine Laboratory	3
Gary Davis	National Biological Survey	1
Tom Dore	Channel Islands National Park	6
Dave Forcucci	University of Miami	7
Becky Frodsham	University of Calif. Santa Barbara	6
Laura Gorodezky	NOAA/Channel Islands NMS	2
Peter Haaker	California Dept. of Fish and Game	6
Christine Jackson	California State Univ. Humboldt	4
Gabriel Johnson	University of Calif. Santa Barbara	5
David Kushner	Channel Islands National Park	1,2,3,4,5,6,7
Derek Lerma	Channel Islands National Park	1,2,3,4,5,6,7
Daniel Martin	University of Calif. Santa Barbara	6
Al Mateo	University of Calif. Santa Barbara	5
David Matras	Wrigley Marine Science Center	5
Carolyn Meyer	Channel Islands National Park VIP	1
Jeffrey Mondragon	Channel Islands National Park	1,2,3,4,5,6,7
Jennifer Morgan	Channel Islands National Park	1,2,3,4,5
Michael Pentony	Channel Islands National Park VIP	1,2,3,4
Mitchell Perdue	United States Navy	4
John Provo	Channel Islands National Park	1,2,3,4,5,6
Dan Richards	Channel Islands National Park	7
Diane Richardson	Channel Islands National Park	1,2,3,4,5,7
Johnathon Shaffer	California State Univ. Humboldt	3
Holly Snyder	Channel Islands National Park VIP	2
Ian Taniguchi	Calif. Dept. of Fish and Game	4
John Trone	University of California Santa Cruz	7
Ronald Walder	Moss Landing Marine Laboratory	1
Jill Zamzow	University of Calif. Santa Cruz	3

CRUISE NUMBER	CRUISE DATES
Cruise #1	June 19-23, 1995
Cruise #2	July 10-14, 1995
Cruise #3	July 24-28, 1995
Cruise #4	August 7-11, 1995
Cruise #5	August 21-25, 1995
Cruise #6	September 11-15, 1995
Cruise #7	September 25-29, 1995

Table 6. 1995 Echinoderm wasting disease/syndrome observations.

ISLAND/SITE	Sea Star Wasting Disease		Sea Urchin Wasting Syndrome	
	SPECIES OBSERVED	DATE(s)	SPECIES OBSERVED	DATE(s)
San Miguel Island				
Wyckoff Ledge	none		none	
Hare Rock	none		none	
Santa Rosa Island				
Johnson's Lee North	none		none	
Johnson's Lee South	none		none	
Rodes Reef	none		none	
Santa Cruz Island				
Gull Island South	none		2	6/21
Fry's Harbor	none		2	6/19
Pelican Bay	none		none	
Scorpion Anchorage	none		none	
Yellowbanks	none		none	
Anacapa Island				
Admiral's Reef	none		2,3	8/8, 9/17, 9/25
Cathedral Cove	none		none	
Landing Cove	none		none	
Santa Barbara Island				
SE Sea Lion Rookery	none		2,3,6	7/10, 9/11
Arch Point	none		2,6	7/12, 9/12
Cat Canyon	none		none	

SPECIES LEGEND:

1 = *Patiria miniata*
2 = *Strongylocentrotus purpuratus*
3 = *Lytechinus anamesus*
4 = *Pisaster giganteus*
5 = *Astrometis sertulifera*
6 = *Strongylocentrotus franciscanus*

none = not observed at this site during our visits in 1995
date = date(s) disease/syndrome was observed

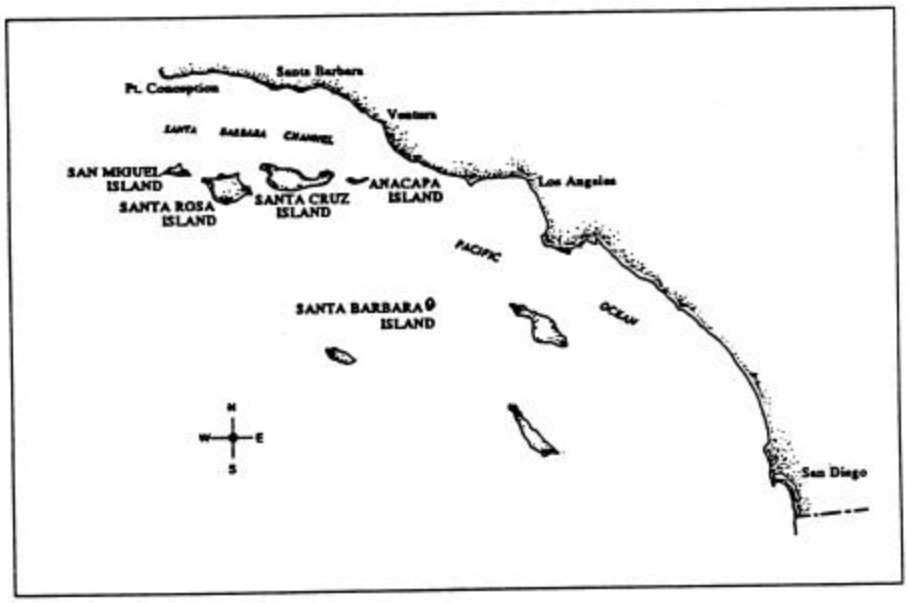


Figure 1. Kelp Forest Monitoring Locations (•) in Channel Islands National Park. Insert shows location of the five park islands in the Southern California Bight.

Appendix I. 1995 Species List for all Channel Islands National Park Kelp Forest Monitoring Stations.

Introduction:

The species list contains presence/absence and relative abundance data for all species that could be found and identified during the site visits between June and September. Generally at least one dive is made by an experienced biologist strictly for species list observations. The overall effort varies from station to station with the water conditions and available time. Relative abundance values are subjective, and generally based on opinions of several divers viewing the overall site. Some species assemblages are more difficult to identify than others and may be lumped into general categories. Organisms were general not collected for additional taxonomic work. When identification is tentative we either do not mark it or place a question mark on the list. Some categories, (e.g. Sponges or tunicates) may be much more diverse than it would appear from the list.

Abundance Ratings:

X - present, no relative abundance rating given
4 - abundant, organism present in higher than normal densities
3 - common, organism found over most of site or in high density patches
2 - present, organism found in moderate numbers
1 - rare, few organisms found
0 - noticeably absent, an effort was made to look for an organism that was not found.

Notes:

e	- eggs
j or jvs	- juvenile
s	- shell only
int	- intertidal
d	- drift
PM or night	- seen only on night dive
JX	- juveniles present and adults present
J#/#	- (e.g. J3/2 - juvenile abundance 3, adult abundance 2)
nests	- *Hypsypops* nest turf
dis	- diseased

Station names are listed in Table 2 of the text.

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
SPECIES																	
CHLOROPHYTA																	
BRYOPSIS CORTICULANS											X						
CLADOPHORA GRAMINEA			X				X										
CLADOPHORA SP.															X	X	
CODIUM CUNEATUM							X				2						
CODIUM FRAGILE							X						X		X	X	
CODIUM SETCHELLII			X	X									X	X			
DERBESIA MARINA			X	X			X				X						
FILLAMENTOUS GREEN ALGAE		X															
GREEN MAT ON SAND									X								
HALICYSTIS OVALIS						3	X				X	X	X	X	X		
ULVA SP.	X	X										X					
PHAEOPHYTA																	
AGARUM FIMBRIATUM					X												
COILODESME CALIFORNICA												2					
COLPOMENIA SP.										X	X		2		X	X	
COLPOMENIA PEREGRINA							X										
CYSTOSEIRA SP.				X		2				2		2	2	1	0	3	
CYSTOSEIRA OSMUNDACEA	2		2	2							2						
DESMARESTIA SP.		1		X	1												
DESMARESTIA LIGULATA	4		4														
DICTYONEUROPSIS RETICULATA	X			2													
DICTYOPTERIS UNDULATA											X						
DICTYOTA BINGHAMIAE			X								X						
DICTYOTA FLABELLATA			X								2						
DICTYOTA/PACHYDICTYON				X		3	2	X	X			3	2		X	4	
ECTOCARPOID FUZZ									X					X			
EGREGIA MENZIESII							X					X					
EISENIA ARBOREA		1	X	J1/0	1	1	J2/2			1	J2/2	J2/X	JX/3		J1/1		
LAMINARIA FARLOWII	2		2	2	2		1			2	2	J2/2	J2/3		X		
MACROCYSTIS PYRIFERA	3	J0/0	4	J3/3	J1/1	J2/2	0	X	JX/X	J0/3	2	J3/2	J3/2		1	J4/4	
PTERYGOPHORA CALIFORNICA	2		3	3						3			JX/2				
ROSENVINGEA FLORIDANA				2													
SARGASSUM SP.								X									
RHODOPHYTA					4					2			2				
ACROSORIUM UNCINATUM			X	X													
BOSSIELLA CALIFORNICA			X	X													
BOSSIELLA ORBIGNIANA			X														
BOSSIELLA/CALLIARTHRON	X						X				2						
BOTRYOCLADIA PSEUDODICHOTOMA				2							1						
BOTRYOGLOSSUM FARLOWIANUM	4		X	X													
CALLIARTHRON CHEILOSPORIOIDES	X		X														
CALLIARTHRON TUBERCULOSUM	X		X														
CALLOPHYLLIS FIRMA	X																
CALLOPHYLLIS FLABELLULATA	3		3	3													
CALLOPHYLLIS VIOLACEA	3		3	3													

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
CARPOPELTIS BUSHIAE			X	X			X										
CERAMIUM SP.			X														
COELOSEIRA COMPRESSA											X						
CORALLINA SP.												3					
CORALLINA OFFICINALIS			2	2			X				2						
CORALLINES - ENCRUSTING	2	2	3	3	3	4	3	3	4	3	4	3	3	4	3	X	
CORALLINES - ERECT	2	1	2	2	1	2	X	X	2	2	2	3	3	2	X	4	
CRYPTONEMIA SP.					X												
CRYPTOPLEURA SP.					4												
CRYPTOPLEURA VIOLACEA	3		2	X													
FAUCHEA SP.	X			X			X										
FRYEELLA GARDNERI				X													
GELIDIUM SP.				X								X				X	
GELIDIUM NUDIFRONS											1						
GELIDIUM PURPURASCENS							3						3		X		
GELIDIUM ROBUSTUM			X								2						
GIGARTINA SP.		X			3								X	1		X	
GIGARTINA CORYMBIFERA	4		3	4													
GIGARTINA SPINOSA											X						
GRACILARIA SP.	X		X														
HALYMENIA SP.			2	2													
HALYMENIA/SCHIZYMENIA	3										X						
IRIDAEA SP.													X				
LAURENCIA SP.		2									X						
LAURENCIA PACIFICA			X	X			X	2	2					2			
LAURENCIA SPECTABILIS	2		2	2													
MICROCLADIA COULTERI	X																
NIENBURGIA ANDERSONIANA	3		2	2													
PHYCODRYS SETCHELLII			X	X													
PIKEA ROBUSTA	2			X													
PLOCAMIUM SP.													X				
PLOCAMIUM CARTILAGINEUM	2										2						
POLYNEURA LATISSIMA	4			X													
RHODOPTILUM PLUMOSUM	2			3													
RHODYMENIA SP.							X										
RHODYMENIA ARBORESCENS			X														
RHODYMENIA CALIFORNICA	4		X	X							2						
RHODYMENIA PACIFICA	3		X														
SARCODIOTHECA GAUDICHAUDII				X													
SCHIZYMENIA SP.				X													
SCIADOPHYCUS STELLATUS							X										
SCINAIA SP.				X													
STENOGRAMME INTERRUPTA				X													
TIFFANIELLA SNYDERIAE				X													
FILAMENTOUS RED ALGAE		3	2	2	X		X		X	X			X	2			
HYPSYPOPS TURF NEST			X										X		3	X	
ANGIOSPERMA																	
PHYLLOSPADIX SP.	D															X	

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
ZOSTERA MARINA	1		D														
BACTERIA																	
DIATOMS																	
DIATOM FILM		X			X				X			2					
PROTOZOA																	
HOMOTREMA RUBRUM			X								X			X		X	
PORIFERA																	
CLATHRINA SP.																X	
CLATHRINA BLANCA							X					X	X				
LEUCETTA LOSANGELENSIS												X					
LEUCILLA NUTTINGI	X											X					
LEUCOSOLENIA ELEANOR					X					X		X	2				
ACARNUS SP.				X													
ACARNUS ERITHACUS						X			1								
CLIONA SP.			X	X							X						
CLIONA CELATA														X			
HALICLONA SP.			X							2			X	2			
HYMENAMPHIASTRA CYANOCRYPTA	2		2	2		2	X		X	X	2		X				
LISSODENDORYX TOPSENTI							X										
MYCALE MACGINITIEI													X				
OPHALITASPONGIA PENNATA	X		X										X				
PENARES CORTIUS				X							X		X				
POLYMASTIA PACHYMASTIA	X		X											1			
RED SPONGES - ENCRUSTING	X		2	2		X	X	X		X	X		X	X	X	X	
SPHECIOSPONGIA CONFOEDERATA			1								1		X				
TETHYA AURANTIA	3	2	2	3	4	2	2		1	2	1		1	3		1	
TETILLA SP.				X													
TETILLA ARB					4												
VERONGIA AUREA							X						X				
APLYSINA FISTULARIS			X								X						
XESTOSPONGIA TRINDINAEA			2	2		X					X						
CNIDARIA																	
HYDROZOA															X	2	
ABIETINARIA SP.			2	2			X										
AGLAOPHENIA SP.										X							
AGLAOPHENIA LATIROSTRIS	3		2	4		X	X				X	3	2	X			
ALLOPORA CALIFORNICA						2											
ANTENELLA AVALONIA											X						
GARVEIA ANNULATA						2											
HYDRACTINIA MILLERII	X		X	X			2	X	X		X	3	X			X	
LYTOCARPUS NUTTINGI											1						
OBELIA SP.	3	X	3	3	X		3	X		X	4	X	X	X			
PHYSOPHORA HYDROSTATICA																	
PLUMULARIA SP.	2		2	2	X		X						X	X			
SERTULARELLA SP.											X	X					
SERTULARIA SP.											X	X					
SERTULARELLA/SERTULARIA	X	X	X		X	X				X			X	X			

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
TUBULARIA SP.														X		
STAUROMEDUSAE	X															
PACHYCERIANTHUS FIMBRIATUS	1		2	2	2	2	X				2		X	X		
CLAVULARIA SP.			X				3				3					
ANTHOZOA																
EUGORGIA RUBENS							1				4					
LOPHOGORGIA SP.												1				
LOPHOGORGIA CHILENSIS	1	0	2	3	X	3	3	2	X	2	3		1	2		
MURICEA CALIFORNICA		0		2	0					X	3	1		2	2	0
MURICEA FRUTICOSA		0			0					X	2		X	2	2	0
EPIZOANTHUS SP.													X		4	
PARAZOANTHUS LUCIFICUM											X					
CORYNACTIS CALIFORNICA	3	3	X	X	2	2	3	X	X	X	2	2	X	2	2	X
ANTHOPLEURA ARTEMISIA			2								X					
ANTHOPLEURA ELEGANTISSIMA	X		2				X		1				X			
CACTOSOMA ARENARIA			X													
EPIACTIS PROLIFERA	X		3	X	2		X			X		X	X			
HALCAMPA DECEMTENTACULATA		X	3	X		2										
METRIDIUM EXILIS			X													
PHYLACTIS SP.														X		
TEALIA COLUMBIANA				2	3											
TEALIA CORIACEA			X	3	X	2	2		X	3	X	X	X	3	X	X
TEALIA LOFOTENSIS	2	X	2	3	2											
ZAOLUTUS ACTIUS	X		2			2									X	X
ORDER MADREPORARIA																
ASTRANGIA LAJOLLENSIS (=A. HAIMEI)	0	4	2	2	3	3	4	2	2	X	3	2	2	3	X	X
BALANOPHYLLIA ELEGANS	3	3	3	2	3	4	2	X	2	1	2	1	1	2	1	X
COENOCYATHUS BOWERSI							3									
PARACYATHUS STEARNSI (=P. STEARNSII)	2	3	2	2		2	2	X	X	X	2	X	2	2		X
CTENOPHORA																
PLATYHELMINTHES		X				X	X	3		X		X	X			
NEMERTEA						X		X		X						
TUBULANUS SEXLINEATUS		X														
TUBULANUS SP.	X															
SIPUNCULA																
THEMISTE PYROIDES	X		2	3												
ANNELIDA																
POLYCHAETA																
ARCTONOE SP.						X				X			X			
ARCTONOE PULCHRA			X	X			X				X					
ARCTONOE VITTATA														X		
ARCTONOE ON DERMESTERIAS						4										
CHAETOPTERUS VARIOPEDATUS	0	2	X	X	4	X	3	X	X	2	2	X	2	3	X	X
DIOPATRA ORNATA	3	X	3	3	2	3	X	X		2		2	X			X
DODECACERIA FEWKESI	2	4			X	2	X				2		X		2	X
EUDISTYLIA POLYMORPHA	2	2	X	X			1									
FLABELLIGERA ESSENBERGE						X										

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT
MESOCHAETOPTERUS SP.									X							
MYXICOLA INFUNDIBULUM	X	X	X	X	2	X	2	2	2		X		X			
OPHIODROMUS PUGETTENSIS	X	X	X	X			X				X					
PHRAGMATOPOMA CALIFORNICA	2		2	X						X		3	X		X	X
PISTA ELONGATA	2	X	X	X	3	X	3		1	2	1	2	2	X	1	
SABELLID	X		X	X												
SABELLID WITH EYESTALK																
SALMACINA TRIBRANCHIATA	X	1	X	X	1	X	X	2	X	2		X	X		X	X
SERPULID	X		X	X												
SPIOCHAETOPTERUS COSTARUM	X															
SPIROBRANCHUS SPINOSUS	X	X	X	X		2	3	4	3	1	4	3	2	2	X	4
SPIROBRANCHUS SPIONID								X								
SPIRORBID		X	3			X		X	X	2	X		3			
TEREBELLID	X	3		X	X	X	2	X	2	X	X	X	X	X		
POLYCHAETE "BALLOONS"		X	X		1			X	2				2			
ARTHROPODA																
PYCNOGONIDA													X			
CRUSTACEA																
CIRRIPEDIA/THORACIA																
BALANUS SP.				X	X	X	X	X		X		X	X	X	X	X
BALANUS AQUILA/NUBILUS		X	X	X												
CONOPEA GALEATA			X	3							X					
MEGABALANUS CALIFORNICUS		X	X	X			X				X		X			
SEMIBALANUS CARIOSUS	X			X			X					X				
MALACOSTRACA																
MYSIDS (brown canopy dwellers)	2			X		1										
MYSIDS (clear bottom dwellers)	4	4			X			X				2		X		
ISOPODA																
CIROLANA SP.								X								
COLIDOTEA													X			3
IDOTEA RESECATA	4		X	X		2				1		X				X
AMPHIPODA																
AMPHIPOD TUBE MASSES			X	X		2	2	X				X			1	X
AMPITHOE HUMERALIS	1															
CAPRELLID					X		2	X					X			
GAMMARID		X	X		X	X	X	X		X		X	X			
COPEPODS										X						X
COPEPODS ON MEGATHURA CRENULATA					X	2			X							
COPEPODS ON FISH		X		X	X		X					X	X	X	X	X
DECAPODA																
ALPHEUS SP.			X				X									
BETAEUS MACGINITIEAE		X				X	X	X	X	X			X			3
LYSMATA CALIFORNICA							X			X			X	X		
PANDALUS DANAE	2	3	3	3		X	X	2		X	2	X	X	X		
SPIRONTOCARIS SP.			X										X			
SPIRONTOCARIS PRIONATA							X									
PANULIRUS INTERRUPTUS							X		2	1	1	4	3		X	X
CRYPTOLITHODES SITCHENSIS			2													

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
HAPALOGASTER CAVICAUDA					X	X				X			X				
ISOCHELES PILOSUS							X						X				
PACHYCHELES SP.			X														
PAGURISTES SP.	X		X	X		X	X			X							
PAGURUS SP.			X		X			X		X	X		X	X			
PETROLISTHES SP.		X	X		X	X	X					X	X				
PYLOPAGURUS SP.											X						
CANCER SP.			S	S												S	
CANCER ANTENNARIUS	X			X	S	X		S	S								
CANCER PRODUCTUS	X				JX/X			S									
HERBSTIA PARVIFRONS		X	X	X	X	X	3	3		X	X	X	X		X		
LOXORHYNCHUS CRISPATUS			X	X													
LOXORHYNCHUS GRANDIS					1			X					X				
PARAXANTHIAS TAYLORI			X			X	X		X	X	X	X	3	2	X		
PELIA TUMIDA						X		X		X		X	X				
PINNOTHERID SP.													X				
PUGETTIA SP.								X									
PUGETTIA PRODUCTA	X		S														
PUGETTIA RICHII	X		X														
SCYRA ACUTIFRONS		X															
TALIEPUS NUTTALLI																S	
ARACHNIDA																	
INSECTA																	
MOLLUSCA																	
GASTROPODA																	
ACMAEA MITRA	X	3	S	S	X								X				
AMPHISSA VERSICOLOR	X	X				3	X	X		3	X		2				
ASTRAEA GIBBEROSA (=Lithopoma gibberosun	2	X			X												
ASTRAEA UNDOSA (=Lithopoma undosum)		S	X		1	X	3	2	J4/4	3	2	4	3	3	4	X	
CALLIOSTOMA SP.					X		X										
CALLIOSTOMA ANNULATUM			X											1			
CALLIOSTOMA LIGATUM							X				X			X			
CALLIOSTOMA SUPRAGRANOSUM	X																
CERATOSTOMA FOLIATUM	X		X	X													
CERATOSTOMA NUTTALLI		X	S			X	X		3		S		X	X	X	X	
CONUS CALIFORNICUS	X	X	X		X	X	3/E	X	2	2	2	X	X	X	X	X	
CREPIPATELLA LINGULATA			X	X		X	X	X	X	X		X	X				
CREPIDULA SP.		X			X	X	X	X	X	X		X	X	X			
CREPIDULA DORSATA	X			X													
CREPIDULA NORRISARUM			X														
CREPIDULA PERFORANS			X														
CYPRAEA SPADICEA	2	2	2	2	2	2	3		X	3	2	X	X	2	X	X	
DIODORA SP.	X	X	X		2												
DIODORA ARNOLDI							X										
EPITONIUM TINCTUM			X										X				
FUSINUS KOBELTI			X	2													
FUSINUS LUTEOPICTUS					X					X							
HALIOTIS CORRUGATA						1	X	S	S	JS/1	2	1	3	S/0	0	J1/1	

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
HALIOTIS CRACHERODII							JS										
HALIOTIS FULGENS													X	0	0	0	
HALIOTIS RUFESCENS	X	J2/0	2	2	1		X										
HIPPONIX TUMENS	X																
HOMALOPOMA SP.		3	2	2	X	2	X			2			X				
KELLETIA KELLETII	X	1	X	X	4	X	2	X	1	2	2		JX/2		0	X	
MAXWELLIA GEMMA							X										
MEGATHURA CRENULATA	X	X	X	X	2	2	3	X		X	2	X	X	2	X	X	
MITRA IDAE	X	X	X	X	X	X	2		X				X	X		X	
NASSARIUS SP.			X														
NORRISIA NORRISI			X	X	S	X	X	X	X	X	2	X	X	X	X	2	
OLIVELLA SP.												X					
OLIVELLA BIPLICATA	X		S														
PETALOCONCHUS MONTEREYENSIS	X																
PSEUDOMELATOMA TOROSA			X														
SERPULORBIS SQUAMIGERUS	X	2	2	2		X	2		3		2		2	2	X	X	
SIMNIA VIDLERI (=Neosimnia)							X				2						
TEGULA SP.													X		X	X	
TEGULA EISENI							2		3					X			
TEGULA REGINA							X						X	X			
TRIVIA SP.		X			S												
TRIVIA CALIFORNIANA			S														
TRIVIA SOLANDRI								X		2	S		2	X			
VOLVARINA TAENIOLATA		X				X	X	2		X			X				
APLYSIA SP.														3			
APLYSIA CALIFORNICA		X			1	X	1	X	3		2	X	2	2	2	2	
APLYSIA VACCARIA								X				2					
BERTHELLINA ENGELI			X			2	X	2				2	X				
NAVANAX INERMIS		X	X	3			E/3	X	X		X	2	X	X			
ACANTHODORIS LUTEA			X														
AEOLIDIA PAPILLOSA			X														
ANISODORIS NOBILIS	X	X	X	X		X			X								
CADLINA FLAVOMACULATA	X																
CADLINA LUTEOMARGINATA				X													
CHROMODORIS MACFARLANDI		X															
DENDRODORIS N.SP.		X			X												
DIAULULA SANDIEGENSIS			X	X		X			X		X						
DORIOPSILLA ALBOPUNCTATA	X		X	X							X						
FLABELLINOPSIS IODINEA (=Coryphella iodinea)			X	X		X	X		X		2	2	X		X		
HERMISSENDA CRASSICORNIS	X	2	X	2		X	3							X			
LAILA COCKERELLI		X					X				X						
MEXICHROMIS PORTERAE			X	X			X		X				X	X			
PHIDIANA PUGNAX		X	X	X	X									X			
POLYCERA ATRA							X										
TRIOPHA CATALINAE		X	2	3		X											
TRITONIA FESTIVA				X			2										
PULM0NATA																	
ONCHIDELLA BOREALIS														X			

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
POLYPLACOPHORA																	
CALLISTOCHITON SP.	X						X										
CYANOPLAX SP. (=Lepidochitona)	X																
TONICELLA LINEATA	X	X															
BIVALVIA																	
AMERICARDIA BIANGULATA						S	S	S									
CHACEIA OVOIDEA			X	X													
CHAMA ARCANA		X	X	X		X	3	3			3	X	4	X	X		
GARI CALIFORNICA			S	S			S		S		S						
HIATELLA ARTICA			X	X													
HINNITES GIGANTEUS (=Crassedoma giganteu	X	X	X	X	JS3/X	J2/X	2	2	X	JX/2	3	3	4	1	X		
LIMA HEMPHILLI	S	S	S	S	X		X	X	S		S		S				
MYTILUS CALIFORNIANUS		X					INT	INT					X				
PARAPHOLUS CALIFORNICUS			X	X													
PECTEN DIEGENSIS			S			S											
PHOLAD	X	X			X	X	X	X	X		X		X	X			
PODODESMUS CEPIO		3	X	3	X	2	X		X		X		X	1			
SEMELE SP.														X			
SEMELE RUPICOLA			S														
TELLINA SP.	X																
TELLINA CARPENTERI			S														
VENTRICOLARIA FORDII		S	S	S	S	X	S	X	X	S	S		X	S			
CEPHALAPODA																	
OCTOPUS SP.		X				X	X	X	X	X		3	J2/2	X	3		
OCTOPUS BIMACULATUS/BIMACULOIDES			2+														
ECTOPROCTA																	
AETEA SP.			X				X				X						
ANTROPORA TINCTA	2			X	2		X										
BUGULA SP.							X					3	X		X	2	
BUGULA CALIFORNICA	X		X	X		X				X	X		X				
BUGULA NERITINA		X	X	X	X	X	3			X	3		X	X			
COSTAZIA SP.					X				X								
COSTAZIA ROBERTSONIAE	X		X	X			X			X			X	X			
CRISIA SP.	X		X	X			X				X						
DIAPEROECIA CALIFORNICA		X	2	2	X	2	2	X	X	2	2		X	1	X	X	
EURYSTOMELLA BILABIATA	X		X	X			X										
HIPPODIPLOSIA INSCULPTA	X		X	X		X				X							
LICHENOPORA NOVAE-ZELANDIAE			X	X				X			X			X	X	X	
MEMBRANIPORA SP.		X				X	X	X	X	X		2	X	X	X	X	
MEMBRANIPORA MEMBRANACEA	X		1	1							X						
MEMBRANIPORA TUBERCULATA			X				X										
PARASMITTINA/RHYNCHOZOON			X														
PHIDOLOPORA LABIATA			X	X	X	2	X	X	1	X	X		X	X	X		
THALAMOPORELLA CALIFORNICA			2	2			3	X	2	3	X	3			X	2	
ENTOPROCTA																	
PHORONIDA																	
PHORONIS SP.										X							

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
PHORONOPSIS CALIFORNICA							X										
BRACHIOPODA																	
ECINODERMATA																	
ASTEROIDEA																	
ASTROMETIS SERTULIFERA				X	X		2	X			1						
ASTROPECTEN SP.								2	X					X			
DERMASTERIAS IMBRICATA	X		2	3	3	2				1							
HENRICIA LEVIUSCULA	X		X	X	X		2				3		X	X			
HENRICIA N.SP.	X		X	X													
LINCKIA COLUMBIAE									2		2		X				
LUIDIA FOLIOLATA			X	X													
MEDIASTER AEQUALIS				X		2				1							
ORTHASTERIAS KOEHLERI		X															
ASTERINA MINIATA	X	4	2	4	4	3	3	X	2	1	3	1	X	2	X	X	
PISASTER BREVISPINUS		X	2	3	1		1										
PISASTER GIGANTEUS	X	4	2	2	3	2	3	X	1	1	2		X	X	X	X	
PISASTER OCHRACEUS													X				
PYCNOPODIA HELIANTHOIDES	X	3	3	3	2	2	1			1	X						
ECHINOIDEA																	
CENTROSTEPHANUS CORONATUS							JX/X				2		X	2	2	2	
LOVENIA CORDIFORMIS						S											
LYTECHINUS ANAMESUS					1	X	2	2	2	2	2	1	X	2	X		
LYTECHINUS ANAMESUS JUVENILES									0		0						
STRONGYLOCENTROTUS FRANCISCANUS	2	4	3	3	3	3	3	3	2	2	3	4	4	3	2	4	
STRONGLYOCENTROTUS FRANCISCANUS JUV.		3		X	3	2	X	X	2	2	2	2	3	2	2	2	
STRONGYLOCENTROTUS PURPURATUS	1	2	2	2	2	3	4	4	4	2	4	3	3	4	4	2	
STRONGLYOCENTROTUS PURPURATUS JUV.		X		X	2	2	X	X	3	2	4	2	3	4	4	2	
OPHIUROIDEA																	
AMPHIODIA OCCIDENTALIS			X				X										
OPHIACTIS SIMPLEX			X			X	3								X		
OPHIODERMA PANAMENSE							X				X				X		
OPHIOPLOCUS ESMARKI	X	X	X	X	X	X	X	X	X		X		X	X			
OPHIOPSILA CALIFORNICA					X	2								X			
OPHIOPTERIS PAPILLOSA	X	X	X	X	X			X		3	X		3	X			
OPHIOTHRIX SPICULATA				X	X	1	4		X	2	4		X	X			
HOLOTHUROIDEA																	
CUCUMARIA SP.		X	X	X	X	X	X	X					X				
CUCUMARIA MINIATA	X						X				1		2				
CUCUMARIA PIPERATA	X		2	3		X		X	2				X		X	X	
CUCUMARIA SALMA							3				1						
EUPENTACTA QUINQUESEMITA	X	X	X		4		X	X		X			X	1			
PACHYTHYONE RUBRA						1	4	X					1				
PARASTICHOPUS PARVIMENSIS	X	2	X	X	X	JX/3	JX/2	JX/X	JX/2	JX/2	JX/2	2	2	JX/3	X	X	
CHORDATA																	
UROCHRDATA (TUNICATA)												4					
APLIDIUM SP.				X			X		X	X		X	X	X		X	
APLIDIUM SOLIDUM					X	2											

Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
ASCIDIA VERMIFORMIS				X													
BOLTENIA VILLOSA			X	X	3	X	X										
BOTRYLLOIDES DIEGENSIS												X					
BOTRYLLUS SP.												X					
CIONA INTESTINALIS							X										
CLAVELINA HUNTSMANI	X		X	X		X	X		X			2			X	X	
CNEMIDOCARPA FINMARKIENSIS	X				X		X					X	X				
CYSTODYTES LOBATUS		X	X	X	X	X	X						X				
DIDEMNUM SP.			X	X			X										
DIDEMNUM/TRIDIDEMNUM		X	X	X	X	X	X		X	X	X	X	X	X	X	X	
DISTAPLIA OCCIDENTALIS													X	X			
EUHERDMANIA CLAVIFORMIS			X														
METANDROCARPA TAYLORI					X	X	X		X				X	X			
POLYCLINUM PLANUM			X														
PYURA HAUSTOR	X	X			X	2			X		X		X	X	X	X	
STYELA SP.						1											
STYELA MONTEREYENSIS	2		2	2	X												
TRIDIDEMNUM OPACUM			X	X													
VERTEBRATA																	
CHONDRICHTYES																	
CEPHALOSCYLLIUM VENTRIOSUM			X	X			J4		X								
MYLIOBATIS CALIFORNICA							2		X		X			X		4	
SQUATINA CALIFORNICA				X										1			
TORPEDO CALIFORNICA					1												
OSTEICHTHYES																	
GYMNOTHORAX MORDAX													1	1	1		
GOBIESOX SP.					X					2				X			
SARDINOPS SAGAX								4					4				
ENGRAULIS MORDAX													X				
ATHERINOPS AFFINIS			3	3						X	X						
AULORHYNCHUS FLAVIDUS	4																
SYNGNATHUS ARCTUS															X	X	
RATHBUNELLA HYPOPLECTA							3										
TRACHURUS SYMMETRICUS			X				4										
ALLOCLINUS HOLDERI							2		2		3	3	3	3	3	3	
GIBBONSIA SP.			X	X			X			X	1		X		X		
HETEROSTICHUS ROSTRATUS									X		X		X			J2	
NEOCLINUS BLANCHARDI													X				
NEOCLINUS STEPHANSAE	X						X		X								
ARTEDIUS SP.												X					
ARTEDIUS CORALLINUS	X		2	3													
ARTEDIUS CREASERI							X										
LEIOCOTTUS HIRUNDO	X								X	X			X				
ORTHONOPIAS TRIACIS	2	X	2	X	2	2	X			X	X			X	X	X	
SCORPAENICHTHYS MARMORATUS	X			X									X				
BRACHYISTIUS FRENATUS			1			X	X	X		X	X					2	
RHACOCHILUS VACCA	2	X	2	X	2	X	X		X			X					
EMBIOTOCA JACKSONI	1	X	2	2	JX/2	X	X	J2/2	X	X	X	X	X			2	

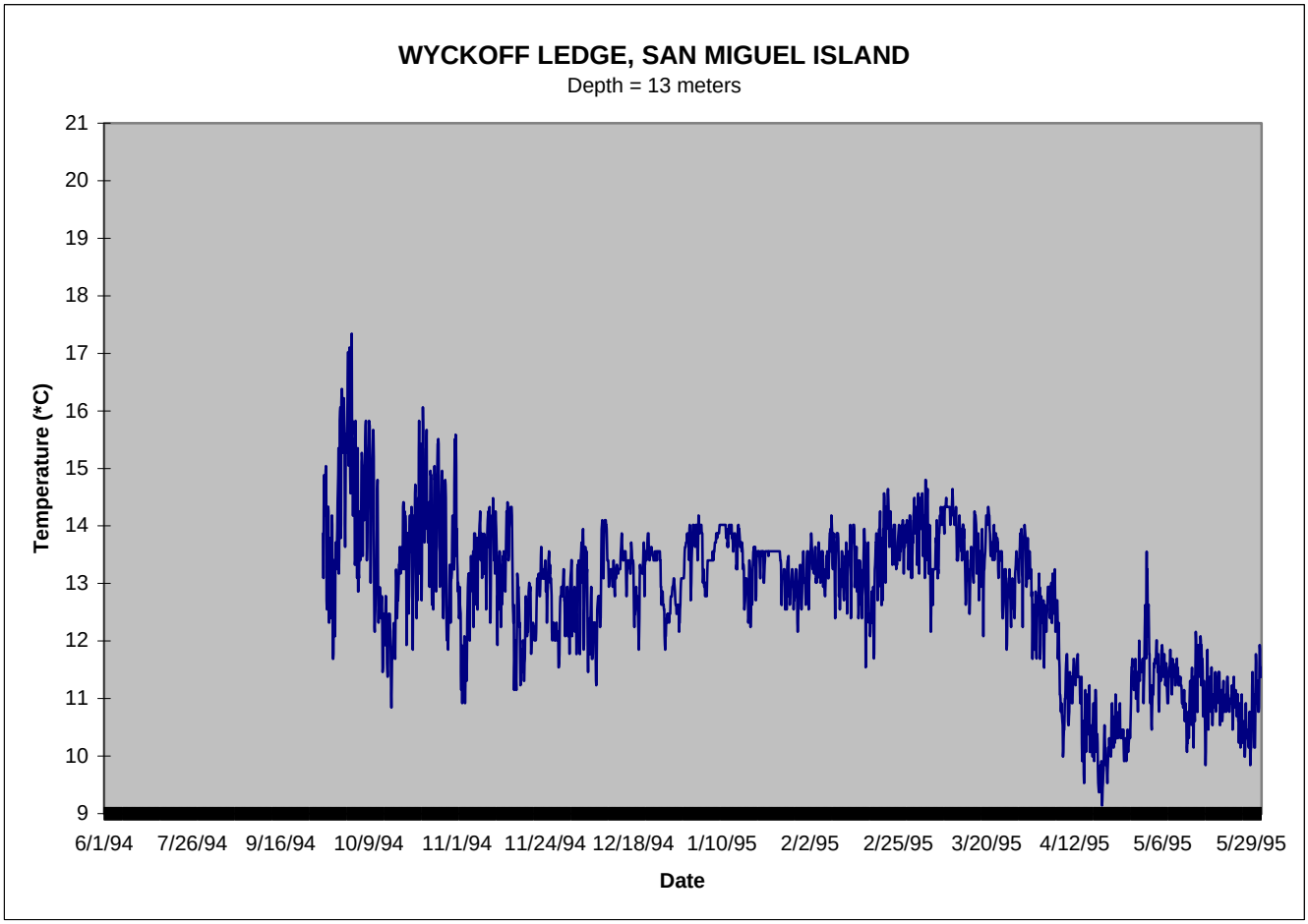
Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
EMBIOTOCA LATERALIS	2	X	X	2	JX/2	X											
HYPSURUS CARYI	2		X	X													
RHACOCHILUS TOXOTES			2	2	2		X	2									
CORYPHOPTERUS NICHOLSI	2	3	2	2	2		3	3	2	3	3	2	X	3	X	X	
LYTHRYPNUS DALLI							2	X				X	X		0	0	
LYTHRYPNUS ZEBRA							2	X	X			X	X	X	0	X	
OPHIODON ELONGATUS		X				X											
OXYLEBIUS PICTUS	2	3	2	2	JX/4	X	3		X		3	X	X	X			
GIRELLA NIGRICANS			X			X	2	X	X		3	X	2	2	3	X	
MEDIALUNA CALIFORNIENSIS				X			X	X	X		2			X	4		
HALICHOERES SEMICINCTUS							X	X				X		X	X	2	
H. SEMICINCTUS (FEMALES)							X		X		2		X	X	X	X	
H. SEMICINCTUS (MALES)							X		X		2			X	X	X	
OXYJULIS CALIFORNICA	3		2	2	2	2	X	X	X	2	2	X		2	2	2	
O. CALIFORNICA (JUVENILES)					0		X			0	0				3	4	
SEMICOSSYPHUS PULCHER												X	X				
S. PULCHER (FEMALES)	2	X	2	2	3	2	4	2	X	2	3	2	X	3	3	3	
S. PULCHER (MALES)	2	X	2	2	3	X	X	1		X	0	2	X	1	1	0	
S. PULCHER (JUVENILES)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
CAULOLATILUS PRINCEPS					X		X	3				2		X			
CHROMIS PUNCTIPINNIS		X	X	X		X	4	2	X	X	3	3	X	X	2	X	
CHROMIS PUNCTIPINNIS (JUVENILES)		0				0	3		0		1	0		0	0	0	
HYPSYPOPS RUBICUNDUS	0		2		0	X	1	X	X		2	X	X	X	3	2	
HYPSOPOPS RUBICUNDUS (JUVENILES)					0		1				X			X	2	2	
SCORPAENA GUTTATA						X				X			X		X	X	
SEBASTES SP. (JUVS.)	4	4	2	2	3	2							3				
SEBASTES AURICULATUS									X	2							
SEBASTES ATROVIRENS	2	2	2	3	2	X	2	2			2		X	X		X	
S. ATROVIRENS (JUVENILES)	X	X	X	X			X										
SEBASTES CARNATUS	X						X										
SEBASTES CAURINUS	X			X	X												
S. CARNATUS/CAURINUS (JUVENILES)	X	X	X	X			X				X						
SEBASTES CHRYSOMELAS	X	X	X		X	X	X		X		2						
SEBASTES MINIATUS	X																
SEBASTES MYSTINUS	X	X			X	X											
S. MYSTINUS (JUVENILES)					X	2	X										
S. PAUCISPINIS (JUVENILES)	X																
SEBASTES RASTRELLIGER									X								
SEBASTES SERRANOIDES		3		X	X	1	2										
S. SERRAN./S. FLAVIDUS (JUVENILES)		X	X	X	X									X			
SEBASTES SERRICEPS	X		X	X		JX/X	2	X	X	X	2		X				
S. SERRICEPS (JUVENILES)				X				2	X	X	2		X				
PARALABRAX CLATHRATUS			2	2	X	X	3	2	X	3	2	3	X	2	X	X	
P. CLATHRATUS (JUVENILES)					0			3	X					0		X	
SPHYRAENA ARGENTEA										X							
PARALICHTHYS CALIFORNICUS														1			
PLATICHTHYS STELLATUS							X	X				X					
PLEURONICHTHYS COENOSUS	X							X		X			X		X		

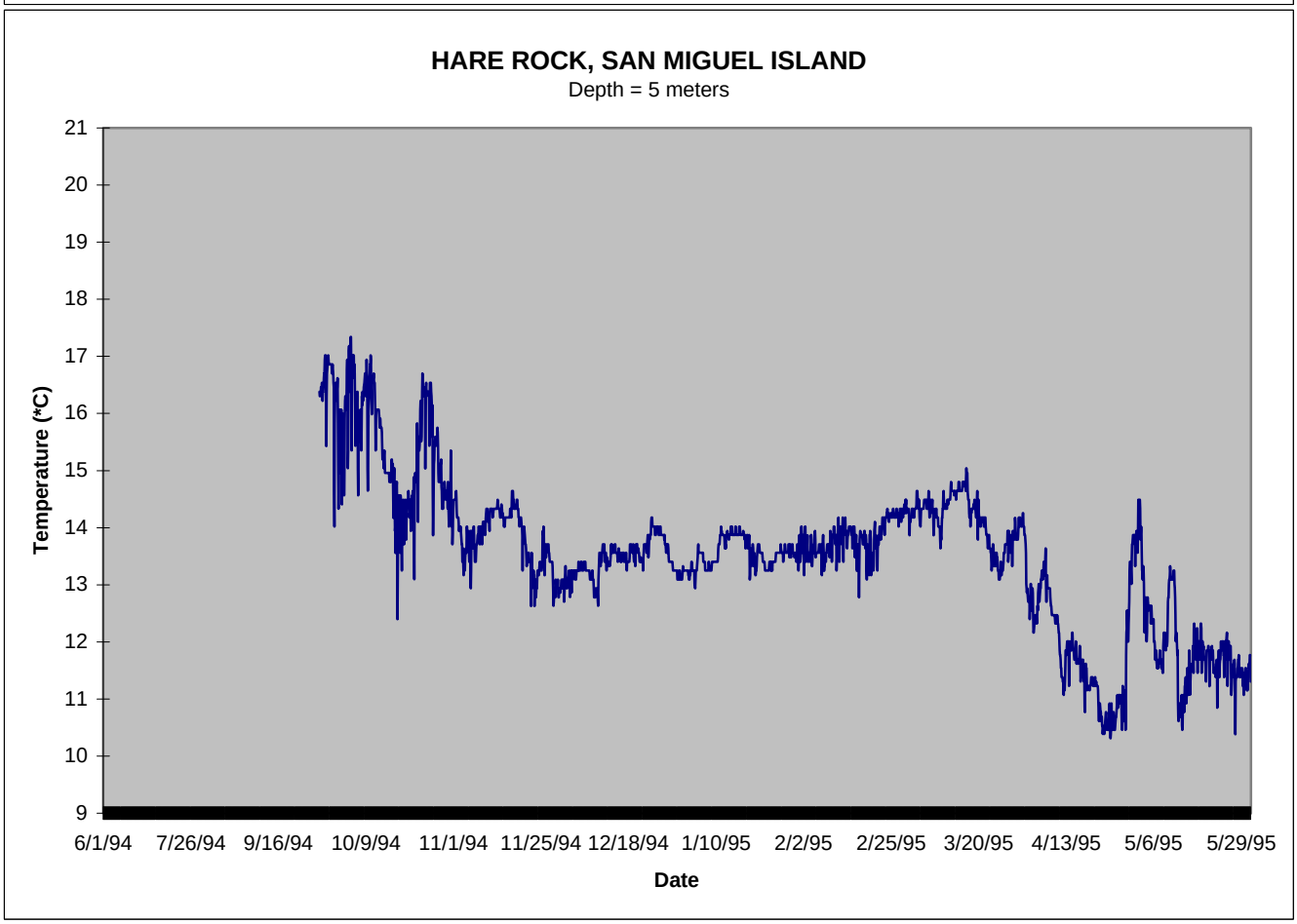
Location:	SMWL	SMHR	SRJLNO	SRJLNO	SRRR	SCGI	SCFH	SCPB	SCSA	SCYB	ANAR	ANCC	ANLC	SBSESL	SBAP	SBCAT	
PHOCA		X					X										
ZALOPHUS							X										
AVES																	

Appendix J. 1995 Temperature data collected at Channel Islands National Park Kelp Forest Monitoring Stations by remote temperature loggers.

Introduction:

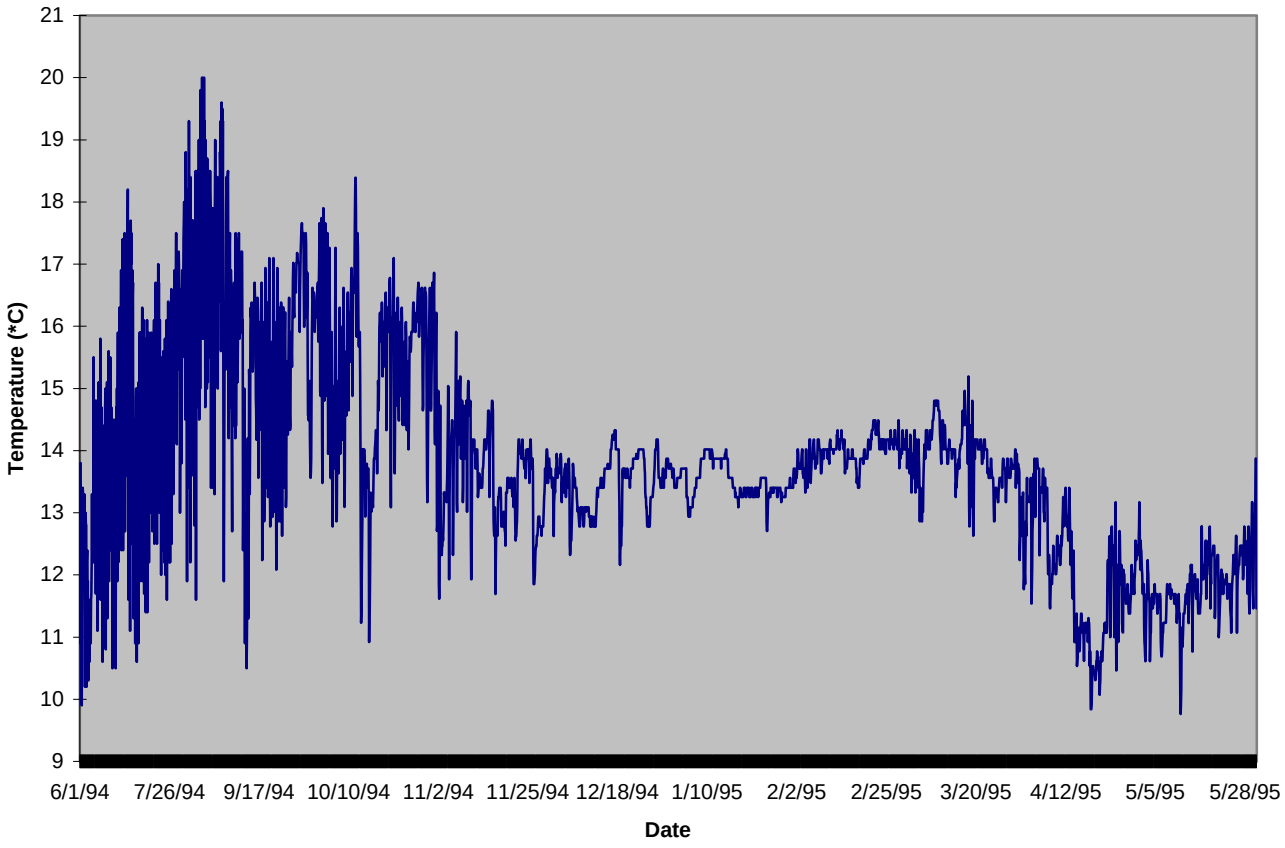
This appendix contains the temperature data (presented graphically) collected by STOWAWAY$^{TM.}$ temperature loggers that were deployed at all 16 Kelp Forest Monitoring sites. Missing data at some sites is the result of technical problems or loss of temperature logger.


WYCKOFF LEDGE, SAN MIGUEL ISLAND
Depth = 13 meters
Temperature (°C)
21
20
19
18
17
16
15
14
13
12
11
10
9
6/1/94
7/26/94
9/16/94
10/9/94
11/1/94
11/24/94
12/18/94
1/10/95
2/2/95
2/25/95
3/20/95
4/12/95
5/6/95
5/29/95
Date


HARE ROCK, SAN MIGUEL ISLAND
Depth = 5 meters
Temperature (°C)
21
20
19
18
17
16
15
14
13
12
11
10
9
6/1/94
7/26/94
9/16/94
10/9/94
11/1/94
11/25/94
12/18/94
1/10/95
2/2/95
2/25/95
3/20/95
4/13/95
5/6/95
5/29/95
Date

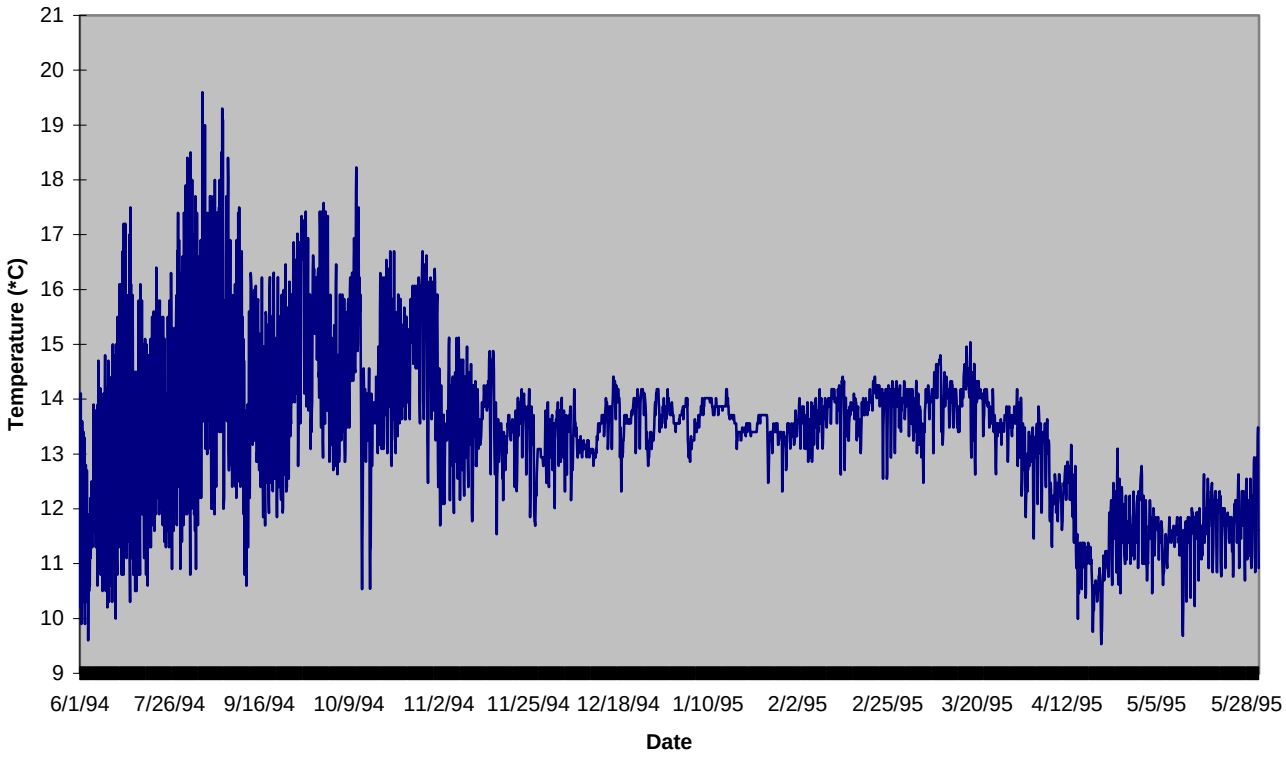
JOHNSON'S LEE NORTH, SANTA ROSA ISLAND

Depth = 11 meters



JOHNSON'S LEE SOUTH, SANTA ROSA ISLAND

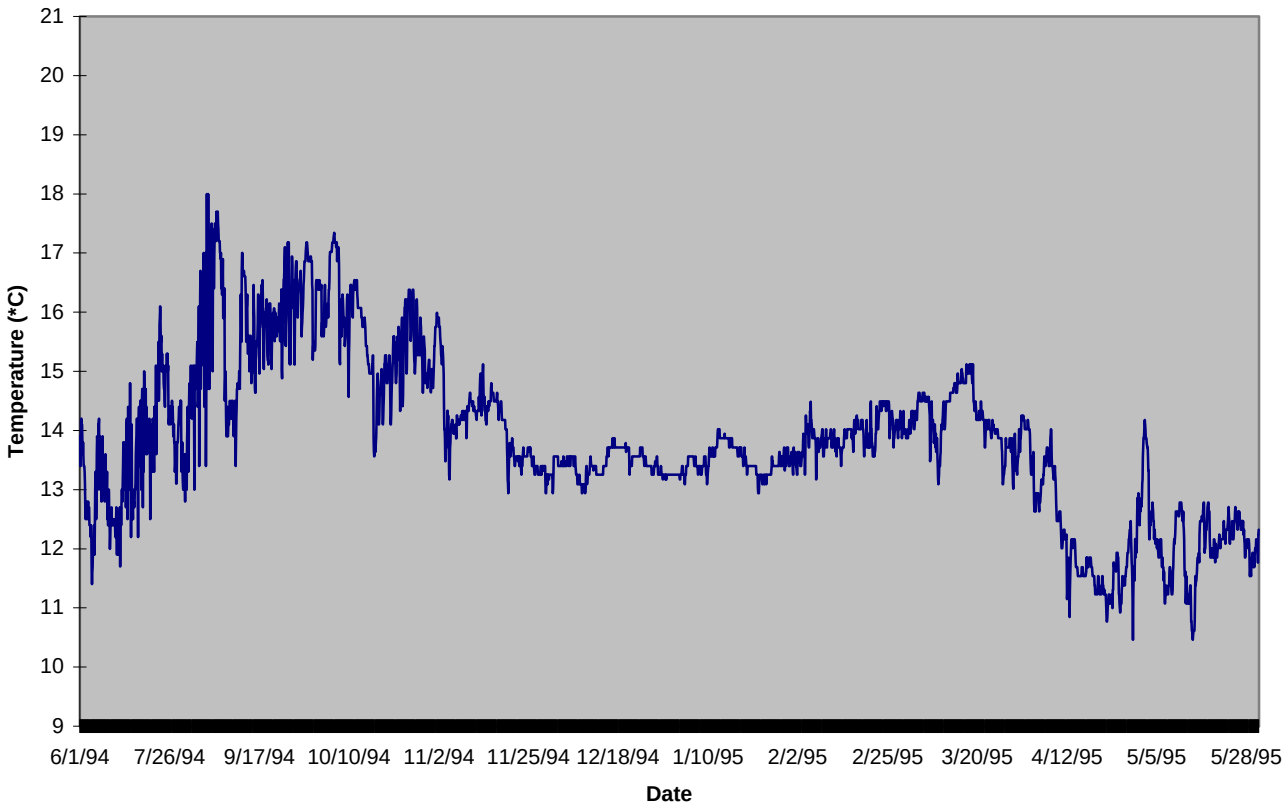
Depth = 16 meters



RODES REEF, SANTA ROSA ISLAND

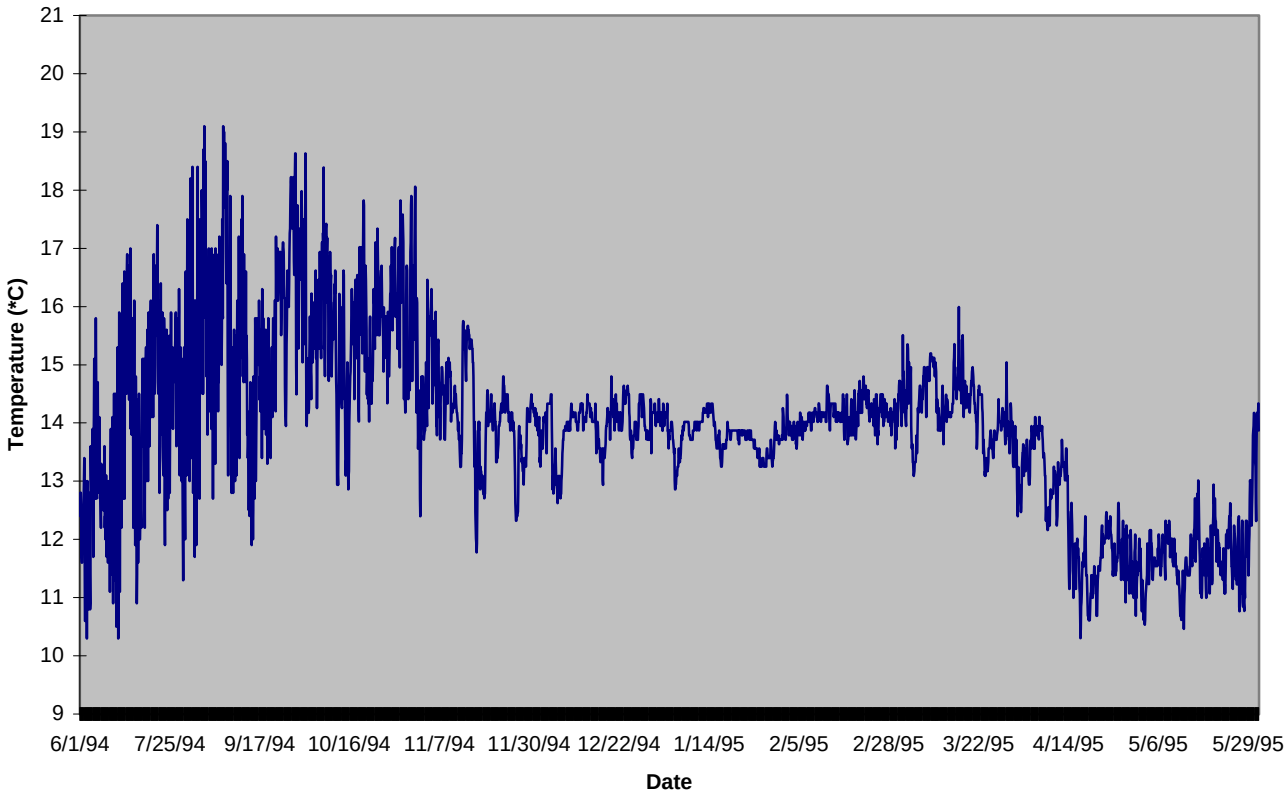
RODES REEF, SANTA ROSA ISLAND

Depth = 13 meters



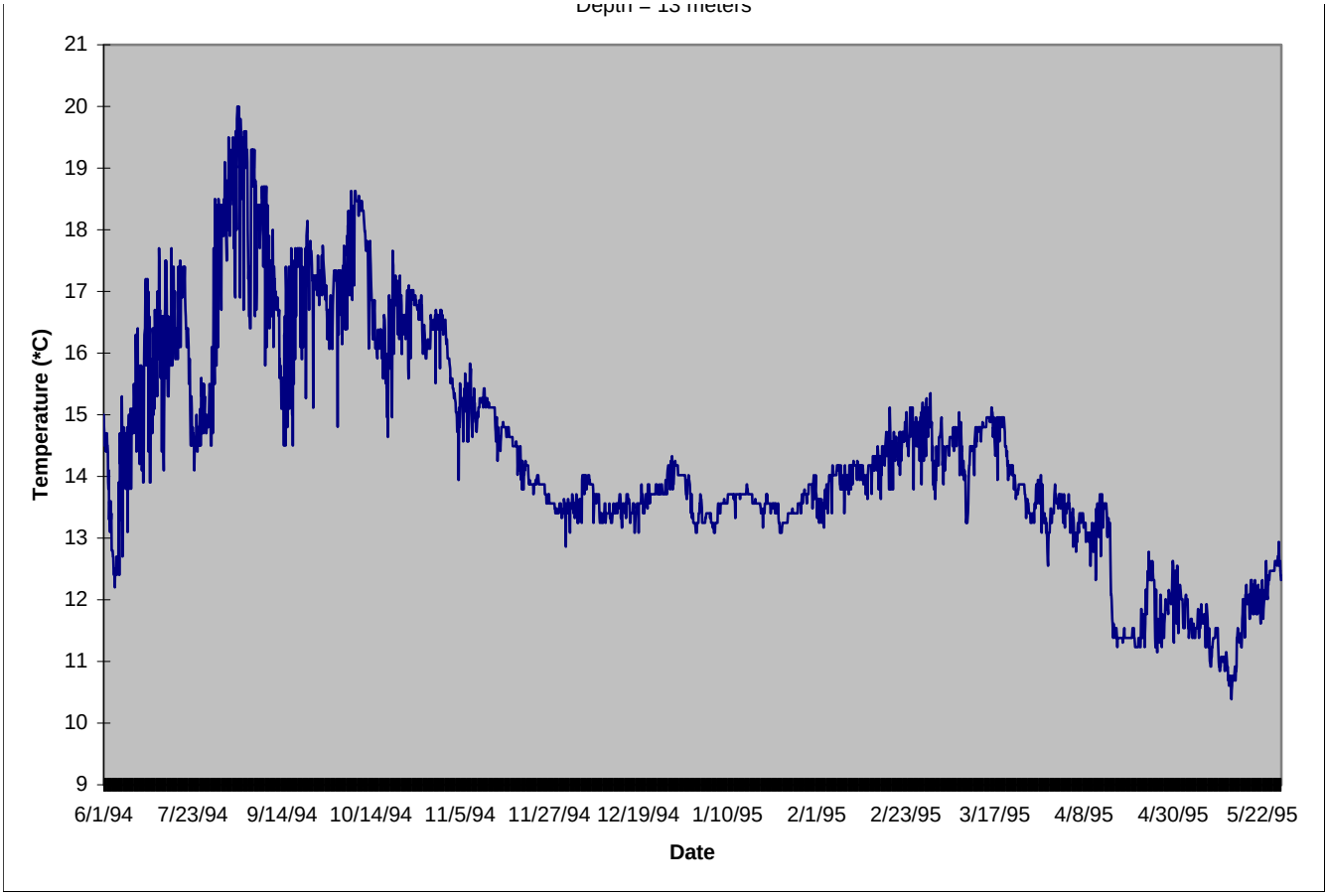
GULL ISLAND, SANTA CRUZ ISLAND

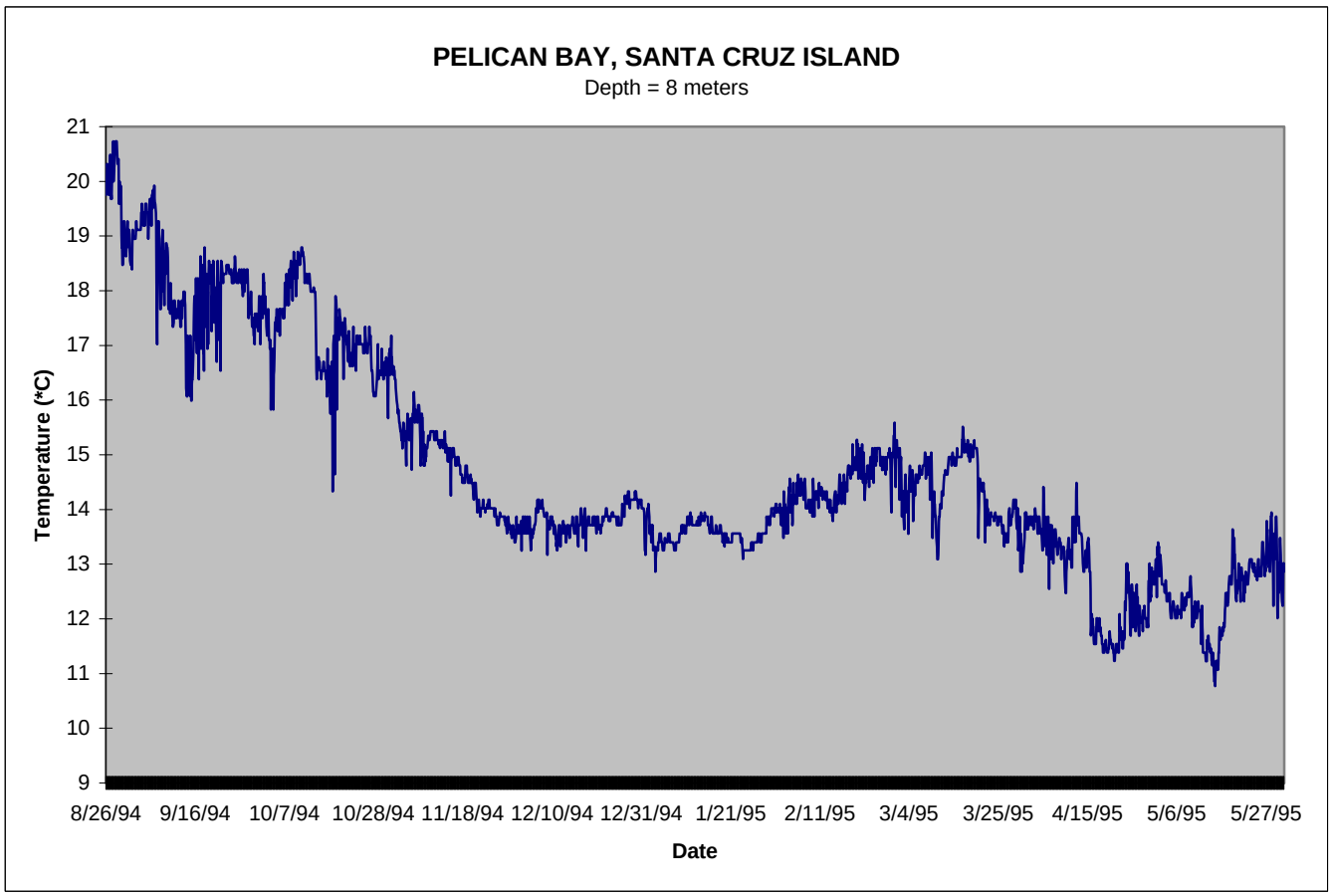
Depth = 15 meters

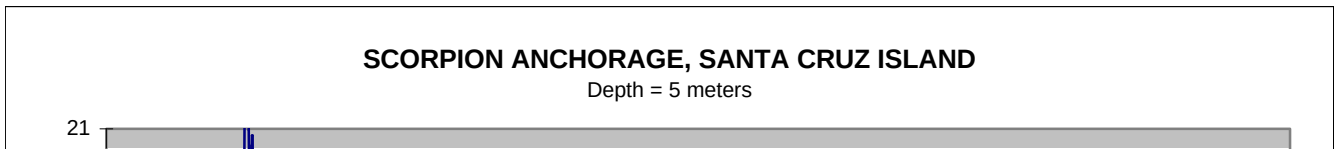


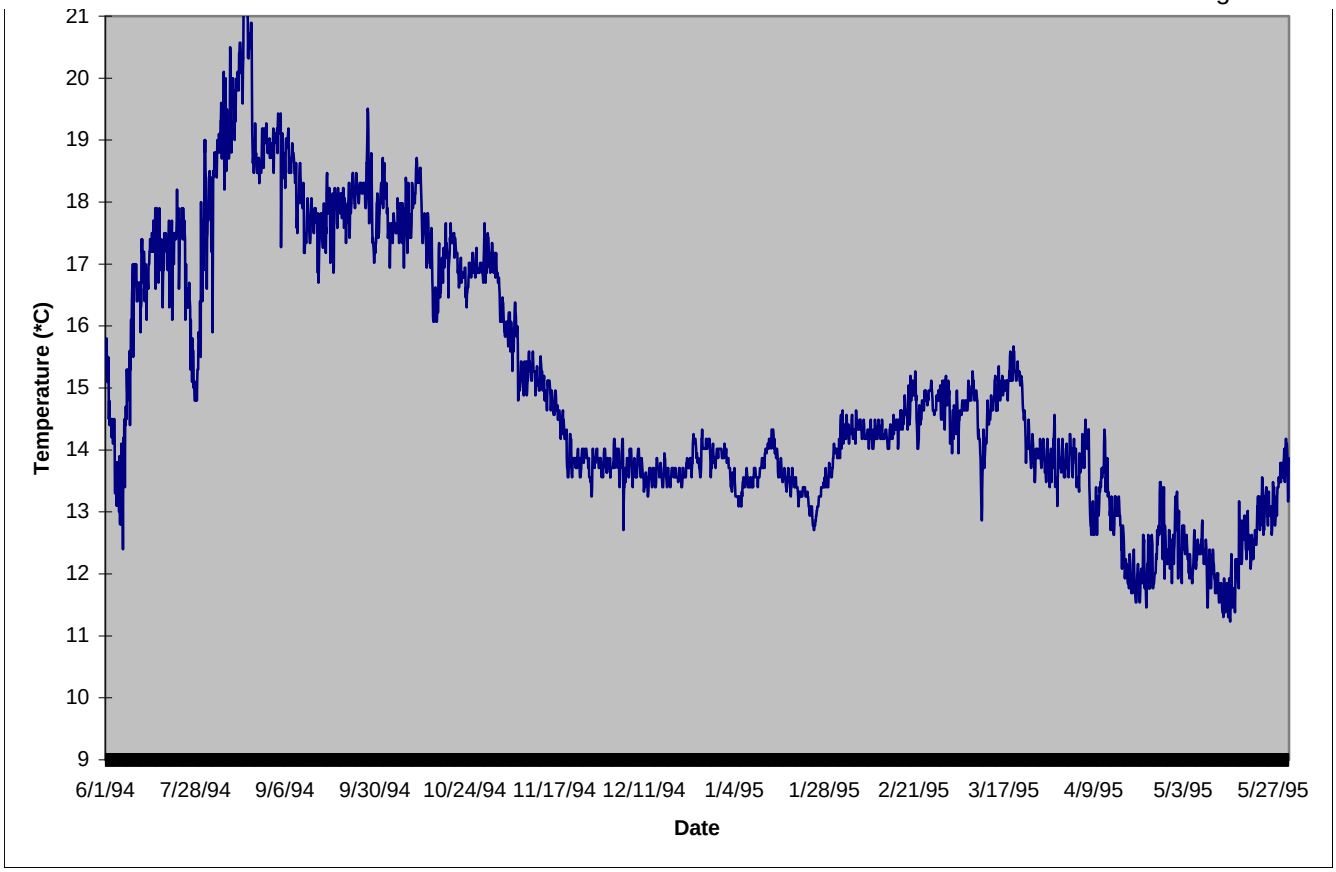
FRY'S HARBOR, SANTA CRUZ ISLAND

Depth = 13 meters


Depth = 13 meters
Temperature (*C)
21
20
19
18
17
16
15
14
13
12
11
10
9
6/1/94
7/23/94
9/14/94
10/14/94
11/5/94
11/27/94
12/19/94
1/10/95
2/1/95
2/23/95
3/17/95
4/8/95
4/30/95
5/22/95
Date

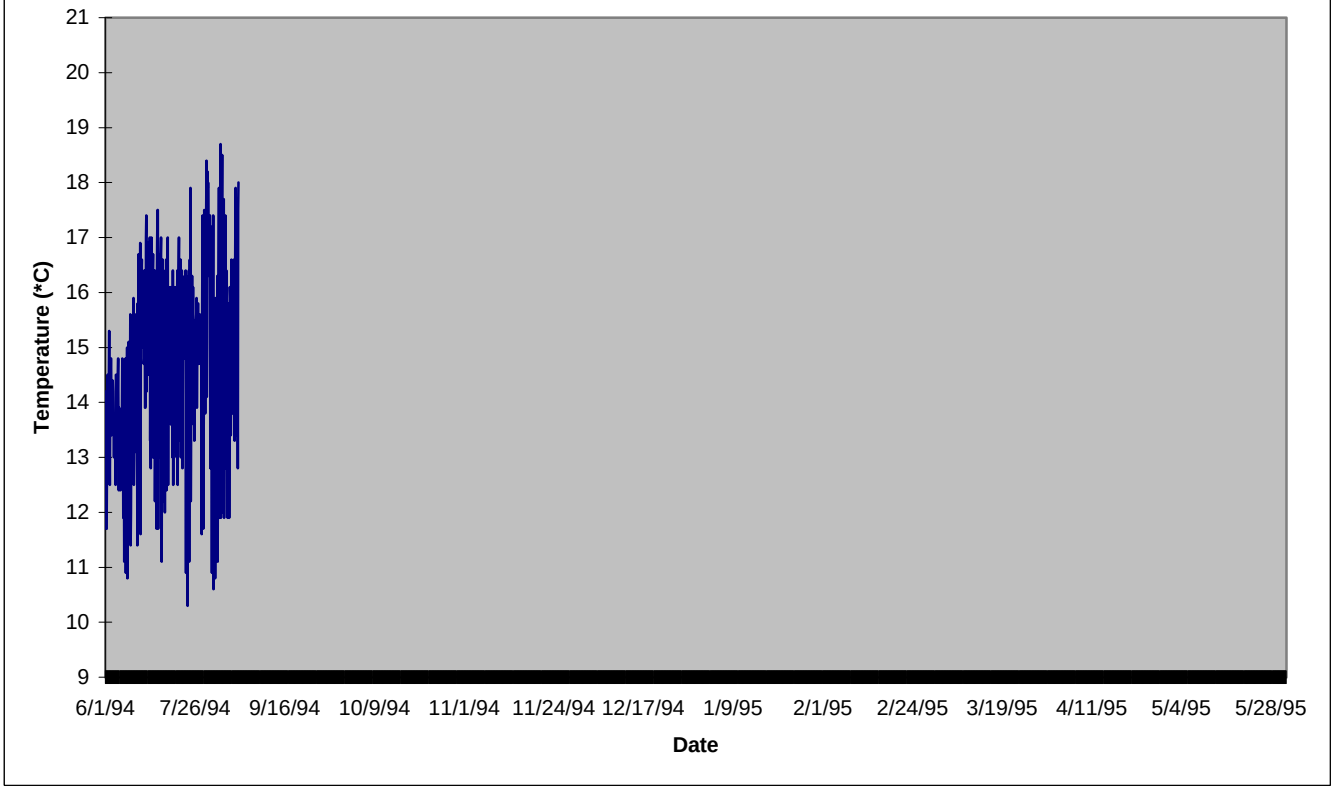

PELICAN BAY, SANTA CRUZ ISLAND
Depth = 8 meters
Temperature (*C)
21
20
19
18
17
16
15
14
13
12
11
10
9
8/26/94
9/16/94
10/7/94
10/28/94
11/18/94
12/10/94
12/31/94
1/21/95
2/11/95
3/4/95
3/25/95
4/15/95
5/6/95
5/27/95
Date


SCORPION ANCHORAGE, SANTA CRUZ ISLAND
Depth = 5 meters
21



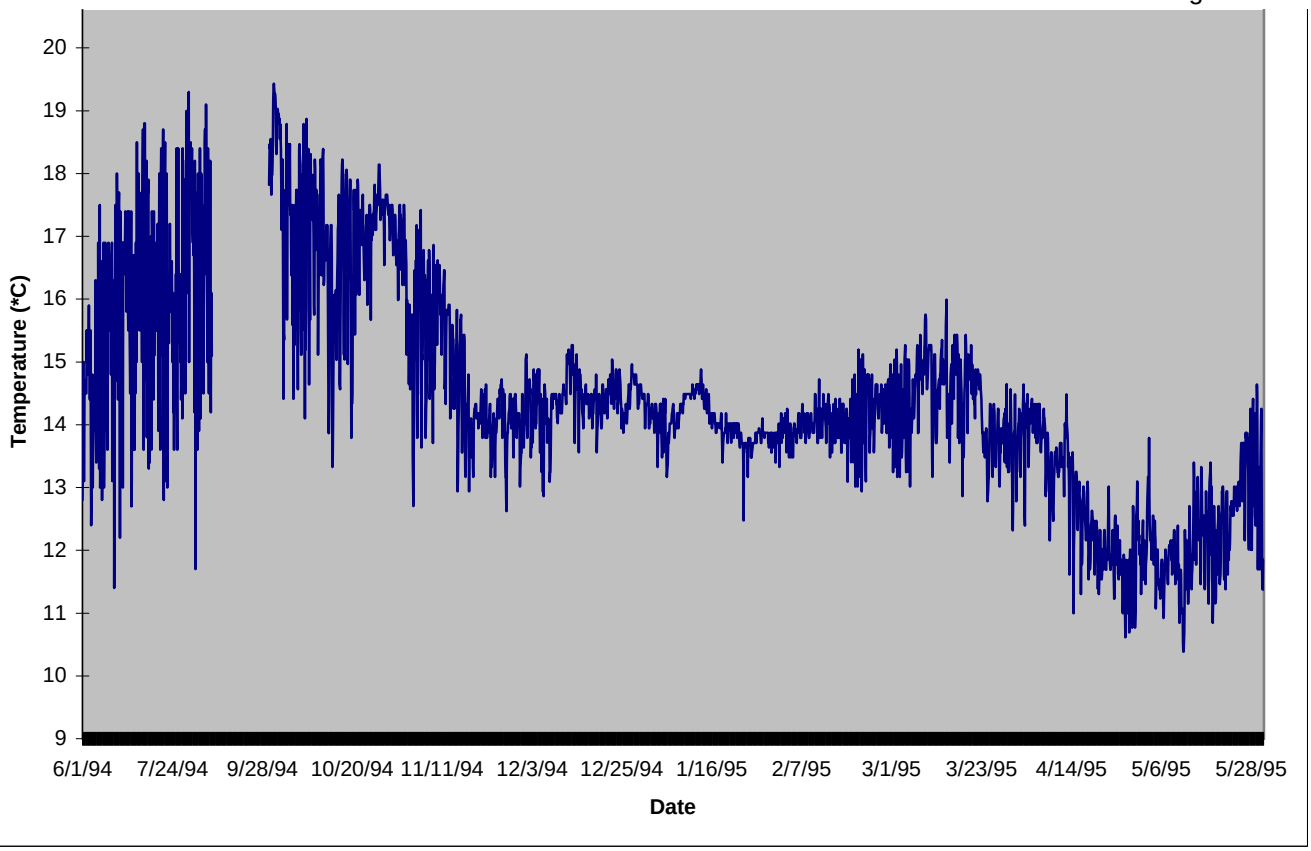
YELLOW BANKS, SANTA CRUZ ISLAND

Depth = 15 meters



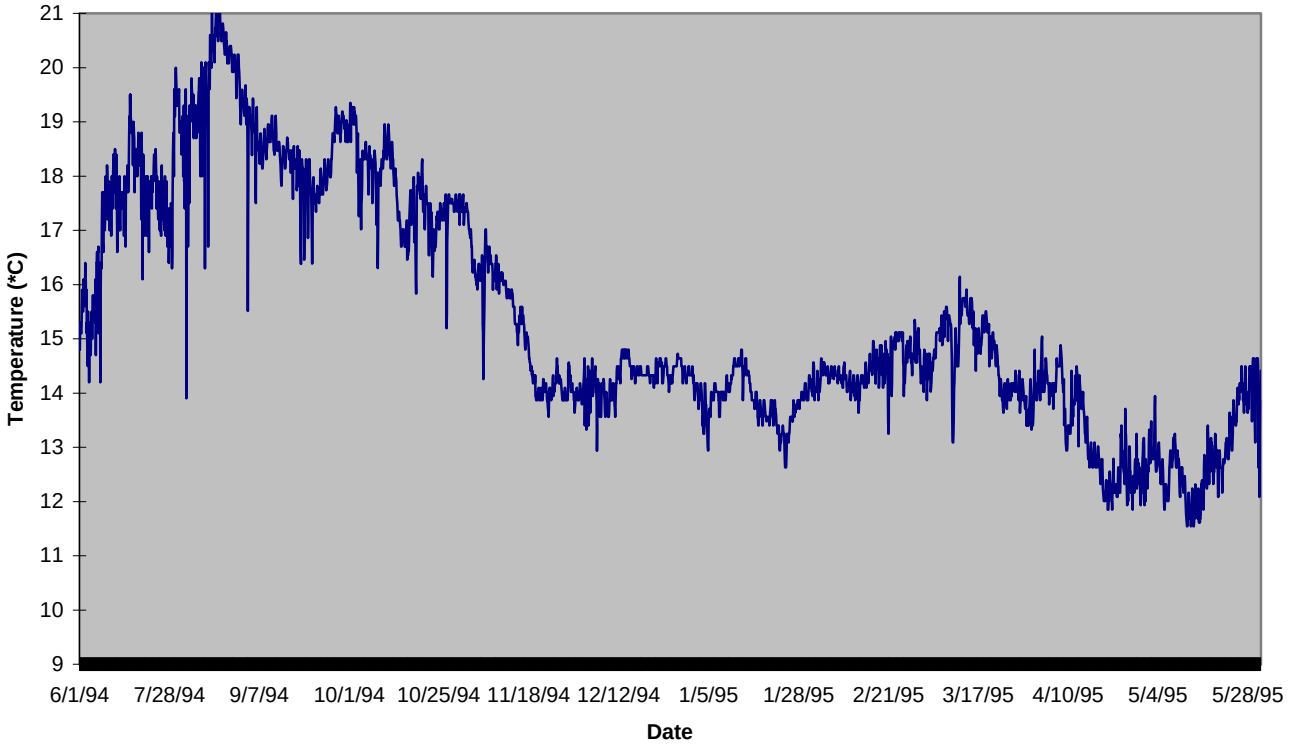
ADMIRAL'S REEF, ANACAPA ISLAND

Depth = 16 meters



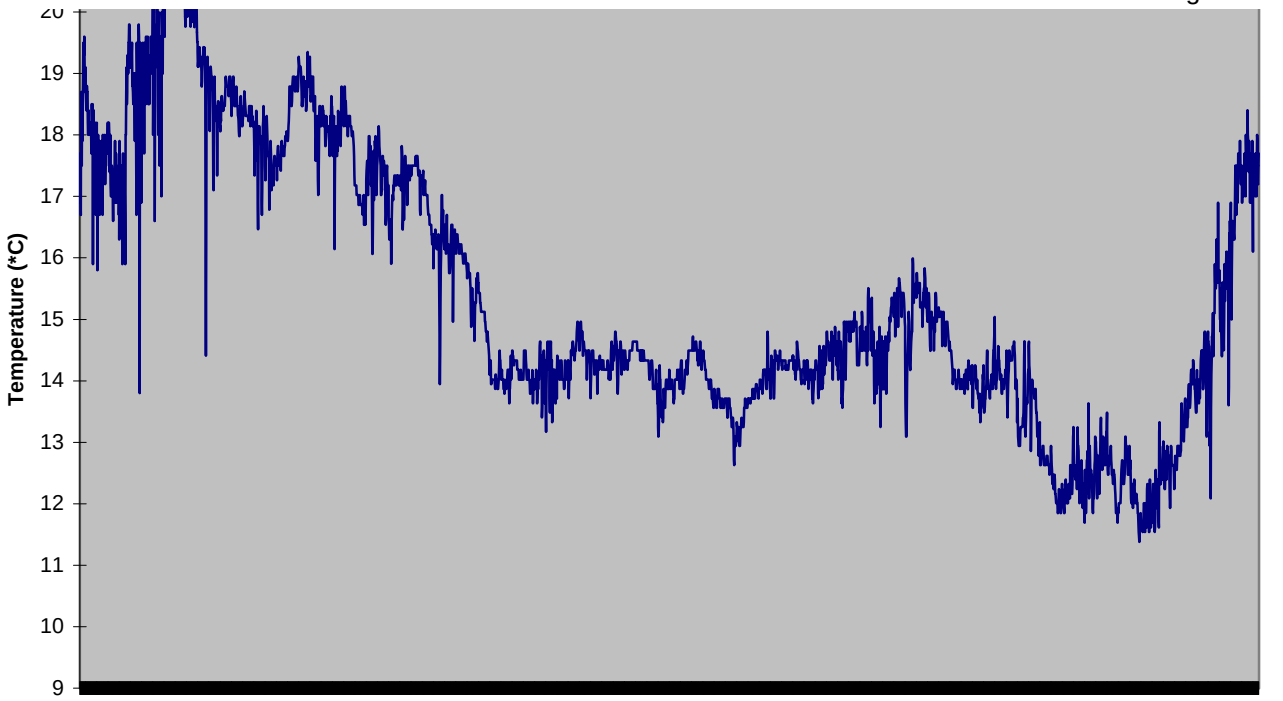
CATHEDRAL COVE, ANACAPA ISLAND

Depth = 6 meters



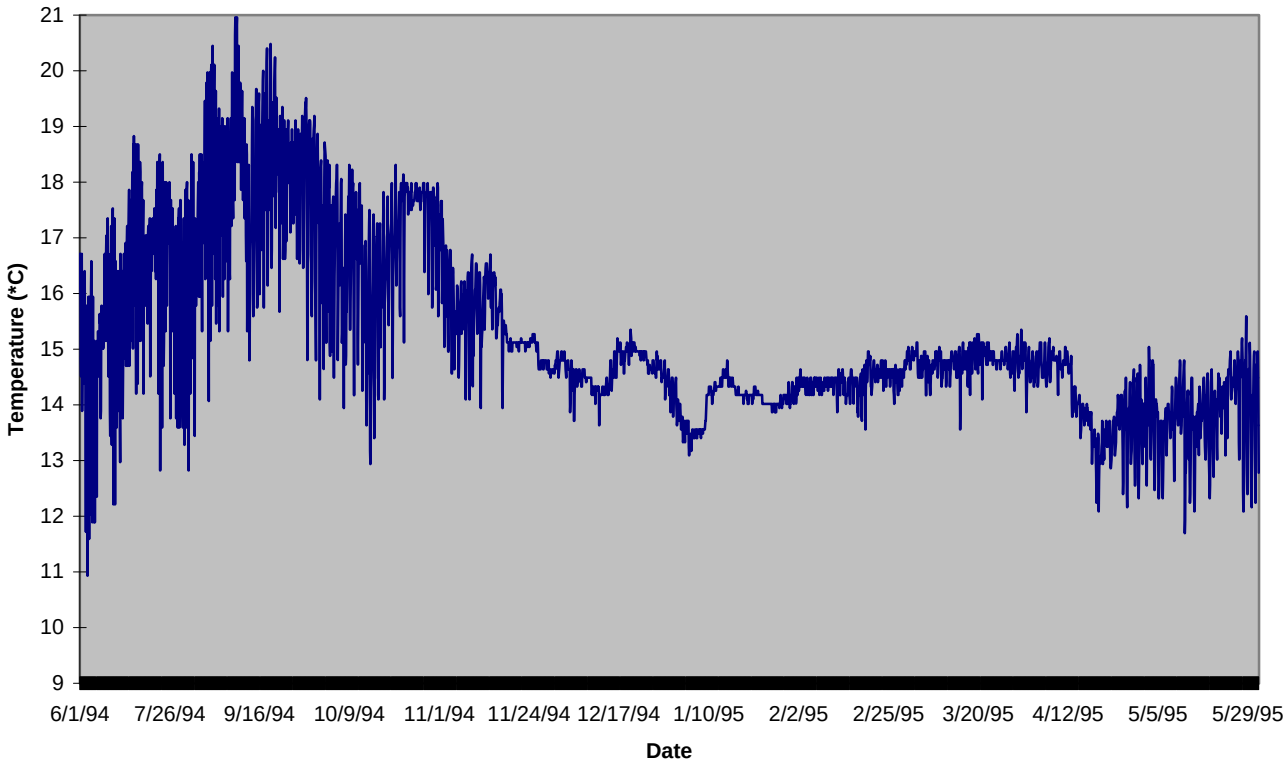
LANDING COVE, ANACAPA ISLAND

Depth = 5 meters



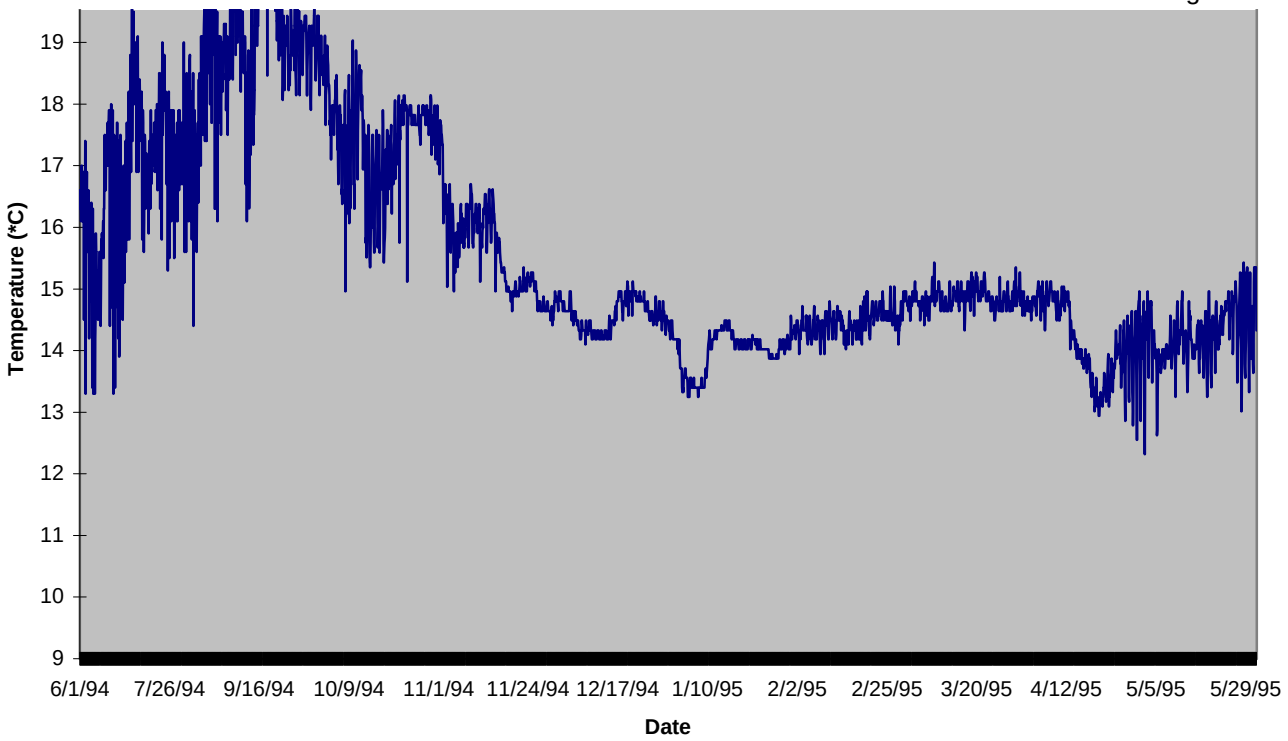
SOUTHEAST SEA LION, SANTA BARBARA ISLAND

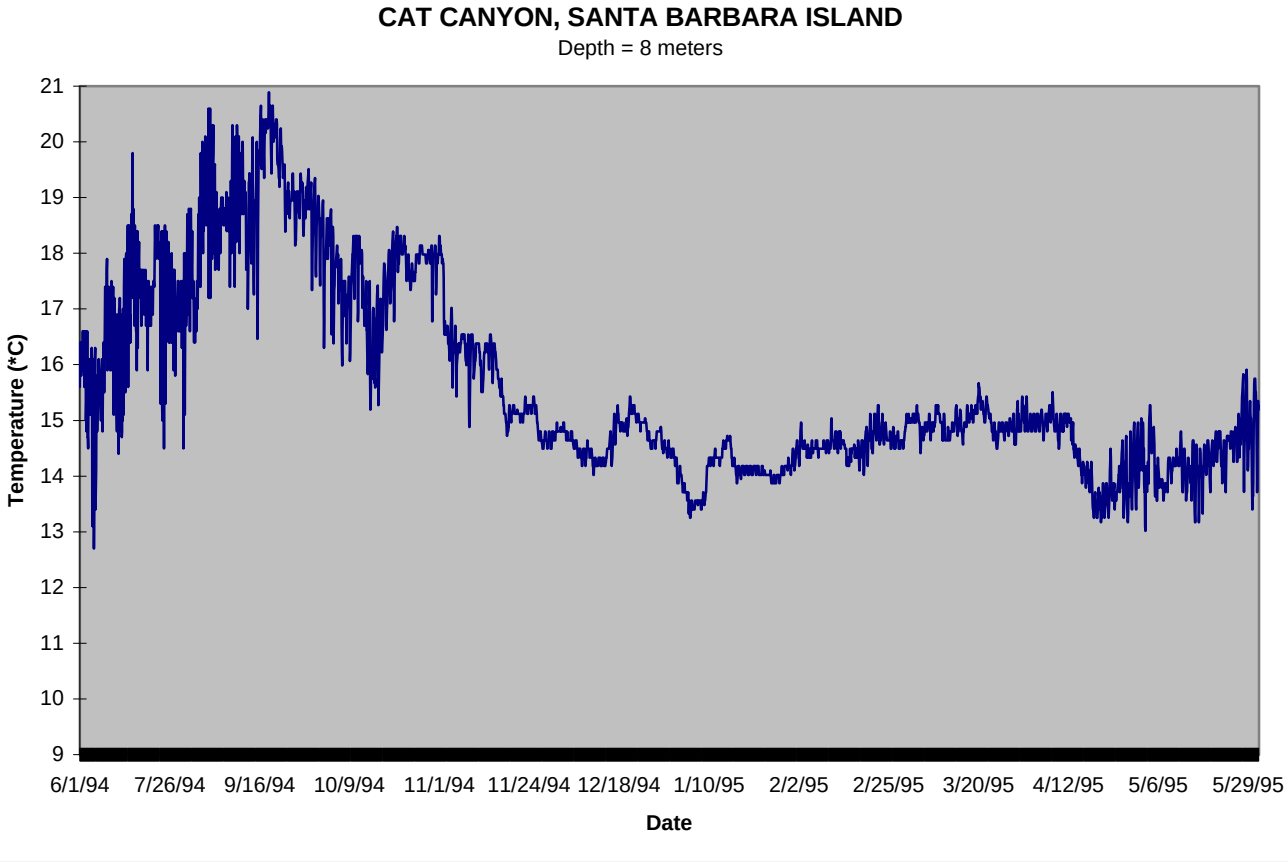
Depth = 12 meters



ARCH POINT, SANTA BARBARA ISLAND

Depth = 7 meters


Temperature (*C)
19
18
17
16
15
14
13
12
11
10
9
6/1/94
7/26/94
9/16/94
10/9/94
11/1/94
11/24/94
12/17/94
1/10/95
2/2/95
2/25/95
3/20/95
4/12/95
5/5/95
5/29/95
Date


CAT CANYON, SANTA BARBARA ISLAND
Depth = 8 meters
Temperature (*C)
21
20
19
18
17
16
15
14
13
12
11
10
9
6/1/94
7/26/94
9/16/94
10/9/94
11/1/94
11/24/94
12/18/94
1/10/95
2/2/95
2/25/95
3/20/95
4/12/95
5/6/95
5/29/95
Date